PAGE'S WEEKLY.—June 30, 1905. Thin Paper Copy for Circulation Abroad.

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SIXPENCE.
(Registered as a Newspaper.)
FRIDAY,
JUNE 30, 1905.

As. 17-42

PAGE'S WEEKLY

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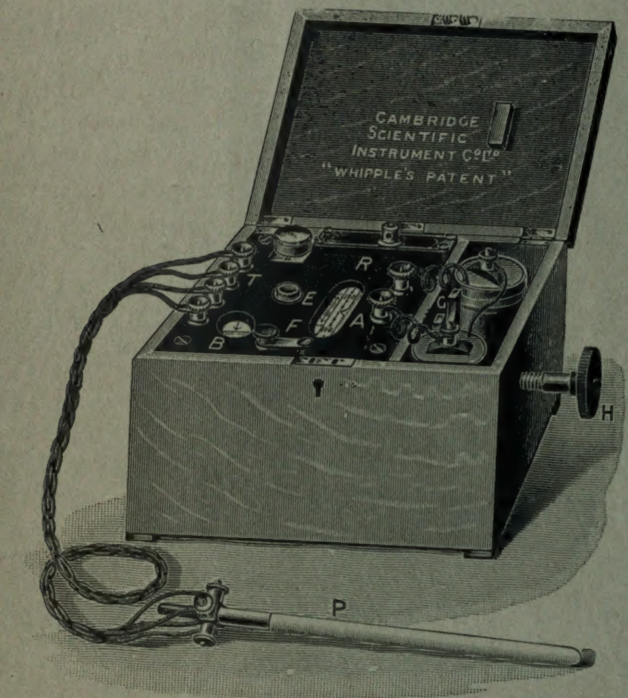

BOILER TRIALS AT SEA.

Electrical Thermometers and Direct Reading Temperature Indicators as supplied by us to the *NAVAL BOILERS COMMITTEE*, whose Report, embodied in a Blue Book, contains the following passage:—

"The temperatures of the flue gases were taken by Callendar Electric Thermometers and read on a Galvanometer made by the Cambridge Scientific Instrument Company for the special purpose of these trials. The whole temperature taking apparatus worked satisfactorily throughout. The records were taken regularly from two to four times per hour, as shown in the tables."

Write for List 25 P to—

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD.,
Cambridge, ENGLAND.

Standard of the World.
J. H. WILLIAMS & CO.,
Drop-forgings only.
Brooklyn, New York

PERFORATED METALS OF ALL KINDS.

MAKERS OF . . .

Filter Press Plates.
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Embossed Plates for Stair Treads and Wagon Steps.
Link Chains for Cranes and Hoists.
Special Designs of Plates made exactly to drawings and up to one inch thick.

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ANDREW BROWN & Co., 110, CANNON STREET, E.C.

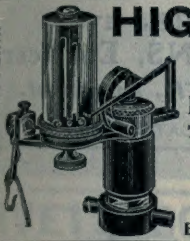
Sole Agents for FRANZ MEGUIN & CO., Ltd.

Telegraphic Address: "BROWPOST, LONDON."

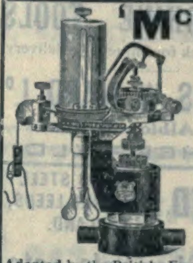
PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars.

PAGE & ROWLINGSON,
Chartered Patent Agents.
Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*
28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.


McINNES'S PATTERN.

HIGH SPEED INDICATORS.
Hannan & Buchanan,
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
Engineering Instrument Makers



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In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
DOBBIE, McINNES, LIMITED,
45, BOTHWELL ST., GLASGOW.
Adopted by the British, French, and Japanese Admiralties.

THE ACME WATER STORAGE and CONSTRUCTION CO., Ltd.,
Patented March 9th, 1897. U.S.A.
Water stored where most convenient under pressure and automatically distributed.
For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.
Descriptive Circular sent on request.
ERIC S. A. SMITH, Water Supply Engineer, BRIDLINGTON.
Licensee, Sole Agent, and Manufacturer for the United Kingdom and Colonies.

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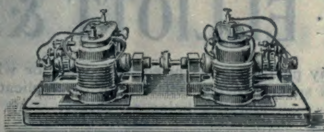
APPLY FOR CATALOGUE.
FALMOUTH ROAD, LONDON, S.E.

Alternating to Continuous Motor Generators.



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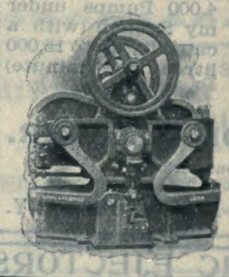
THE CRYPTO ELECTRICAL CO.,
3, Tyers Gateway,
BERMONDSEY ST., S.E.
Telephone: 12830 CENTRAL.



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STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

BABCOCK & WILCOX, Ltd.
PATENT WATER-TUBE BOILERS.
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing July 7th, page 37.
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WORKS—Renfrew, SCOTLAND.

GRAHAM, MORTON & Co., LTD.
Head Office and Works, LEEDS.
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CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

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Horsfall Destructor Co., Ltd., Armley, Leeds.
Telegrams: "DESTRUCTOR." Telephone: 2006.
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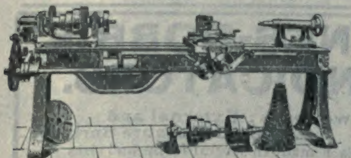
SPECIALISE in the PHOTOGRAPHING of MACHINERY
BOOKER & SULLIVAN, 67 & 69, Chancery Lane, LONDON, W.C.
TERMS ON APPLICATION. Telephone: 9252 CENTRAL.

PAGE'S WEEKLY Miscellaneous

TRANSPORTERS.

See our Advertisement appearing July 7th.

TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."



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In stock for immediate delivery.
THOS. W. WARD, L^D.
Albion Works,
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WALTER SCOTT, LTD., LEEDS STEEL WORKS, LEEDS, ENGLAND.
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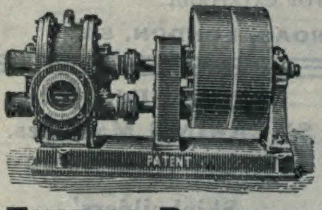
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: TRAMRAILS.

ENKE'S ROTATIVE PUMP

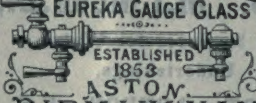


Best of all Systems for all Liquids.

4,000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

ENKE'S PRECISION BLOWER.
Entirely of Iron without packing for high pressures to 0·3 atm.
CARL ENKE, Schkeuditz-Leipzig, GERMANY.

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.
HUGHES & LANCASTER
47, VICTORIA STREET, LONDON, S.W.



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ESTABLISHED 1853
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A NEW GAUGE GLASS,
Samples, Lists, and Testimonials on application.
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Tested to 350lb. Steam Pressure. For High Pressure Boilers.

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Telegrams: PHOTICS, LONDON. Telephone: 293 PADDINGTON.

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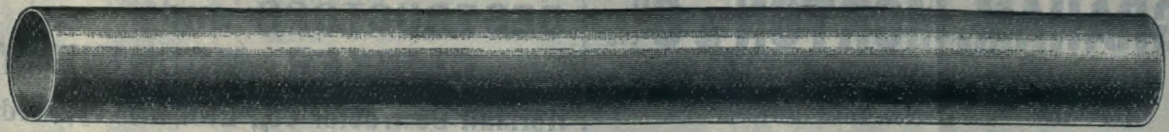

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For further particulars . . of our . . **TIME RECORDERS** see our whole page Ad. on July 7th.

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

PAGE'S WEEKLY Miscellaneous

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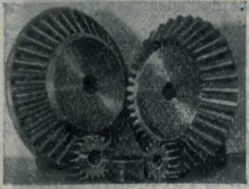
Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.



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A SPECIALITY.
Also all kinds of Metal Gearing.
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Of all Descriptions and for all Purposes.
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T. D. ROBINSON & CO., Ltd.,
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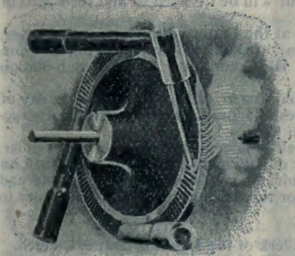
GREENWOOD & BATLEY, Ld.
LEEDS.



Machine Tools.
Dynamos & Motors.
De Laval's Patent Steam Turbines.

BRETT'S PATENT LIFTER Co., LTD.
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing July 7th.
SEND FOR LATEST CATALOGUE.

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,
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Works: MANCHESTER and WORCESTER.

"CAMPBELL"
GAS ENGINES & SUCTION PLANTS, OIL ENGINES & PUMPS.
SOLE MAKERS—
THE CAMPBELL GAS ENGINE CO., *Limited,*
Halifax, England.

London Office—
114, Tooley Street, S.E.

Glasgow Office—
104, Bath Street.

HIGH-CLASS NON-CORROSIVE
LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.
(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)
RELIANCE LUBRICATING OIL CO.,
19 & 20, Water Lane, Great Tower Street.
LONDON, E.C.
Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

A BUSINESS FOR YOU OR YOUR SON.
Chips and Saw-dust FIRELIGHTERS.
GLOVER'S PATENT MACHINERY
ENORMOUS Saves 12 to 80 Men's Work. **PROFITS**
M. GLOVER & CO., Saw Mill Engineers, LEEDS.

EDGAR ALLEN & CO., Limited,
Sheffield.

LATEST TYPES OF POINTS AND CROSSINGS FOR TRAMWAY WORK.

PAGE'S WEEKLY Contracts

CONTRACTS.

CORPORATION OF LEICESTER.

WATERWORKS.
DERWENT SUPPLY MAIN, SECTION No. 1.
CONTRACT No. 2.
TO PIPE FOUNDERS.

The Water Committee of the Leicester Corporation are prepared to receive TENDERS for the SUPPLY and DELIVERY of PIPES and SPECIALS required in connection with Section No. 1 of the Main for bringing the Derwent Supply to Leicester, and for the Blackbrook Temporary Supply, comprising :—

	Tons	cwts.	qrs.	lbs.
32¾ in. Straight Socket Pipes ...	339	0	1	14
32½ in. do. do. ...	2573	7	2	0
32¼ in. do. do. ...	633	12	0	0
15 in. do. do. ...	82	7	0	0
12 in. do. do. ...	210	19	3	7
6 in. do. do. ...	9	7	2	0
Special Castings	163	17	2	16
Total ...	4012	11	3	9

The drawings may be inspected at the offices of the Engineer, Mr. J. B. EVERARD, M.Inst.C.E., 6, Millstone Lane, Leicester, and conditions of contract, specification, quantities, and form of Tender, obtained from him upon payment of £5, which will be returned upon receipt of a *bona fide* Tender, and on the conditions, specification, and priced quantities.

Sealed Tenders upon the form supplied, addressed to the Chairman of the Water Committee, Town Hall, Leicester, are to be delivered not later than ten o'clock in the forenoon of Monday, the 17th day of July, 1905, endorsed "Tender for Pipes—Derwent Main."

The Corporation do not bind themselves to accept the lowest or any Tender.

E. V. HILEY,
June, 1905. Town Clerk, Leicester.

NEWPORT (MON.) ELECTRICITY AND TRAMWAYS DEPARTMENT.

The Electricity Committee are prepared to receive Tenders for the following:—

1. Manufacture and delivery, but without erection, of Cast-iron Exhaust and Water Piping, and Welded Flange Lap Welded Steel Steam Piping.
2. One Steel Water-Cooling Tower, including erection.
3. One Electrically-driven Surface Condenser, including erection.

Particulars may be had from the undersigned upon payment of a deposit of Two Guineas, which will be returned if a *bona fide* Tender is sent in, when the contract is awarded.

Tenders must be received in the envelopes provided not later than July 8th, 1905.

H. COLLINGS BISHOP,
Borough Electrical Engineer and
Tramways Manager.
Town Hall, Newport, Mon.,
June 21st, 1905.

TO ENGINEERS AND OTHERS.

The METROPOLITAN ASYLUMS BOARD invite TENDERS for ALTERATIONS to ENGINEERING ARRANGEMENTS, etc., in LAUNDRY at the SOUTH-EASTERN HOSPITAL, New Cross, S.E., in accordance with Drawings and Specification prepared by Mr. W. T. HATCH, M.I.C.E., M.I.M.E., Engineer-in-Chief.

Drawings, Specification, Conditions of Contract, and Form of Tender may be inspected at the Office of the Board, Embankment, E.C., on and after June 19th, 1905, and can then be obtained upon payment of a deposit of £2, but applications for same will not be entertained after Saturday, July 1st, 1905.

The amount of the deposit will be returned only to persons who have sent in *bonâ fide* Tenders and returned Drawings and Specification in accordance with the regulations.

Tenders, addressed as noted on the form, must be delivered at the Office of the Board not later than 10 a.m. on Tuesday, July 11th, 1905.

By order,
T. DUNCOMBE MANN,
June 10th, 1905. Clerk to the Board.

VICTORIAN RAILWAYS.

TENDERS are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISHPLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the tender box at the Railway Offices, Melbourne, Victoria, Australia, or at the Office of the AGENT-GENERAL FOR VICTORIA, 142, Queen Victoria Street, London, E.C., before 1 p.m., Monday, the 7th August.

Specifications and Drawings will be available at the Agent-General's Office on the 18th June.

BRUMBY AND FRODINGHAM WATER-WORKS.

CONTRACT No. 4.

The Brumby and Frodingham Urban District Council invite TENDERS for SUPPLYING, ERECTING, SETTING TO WORK, and MAINTAINING TWO SETS of PUMPING ENGINES and BOILERS, each capable of raising 100 gallons per minute.

The specification and form of Tender may be obtained from Mr. ALFRED ATKINSON, C.E., of Brigg, on payment of a deposit of £2, which will be returned on the receipt of a *bona fide* Tender, accompanied by the documents.

Sealed Tenders, on the forms supplied endorsed "Tender for Pumping Engines," must be delivered at my office not later than Ten o'clock a.m. on Monday, July 10th, 1905.

The Brumby and Frodingham Urban District Council do not bind themselves to accept the lowest or any Tender.

G. S. SOWTER,
Brigg, June 20th, 1905. Clerk to the Council.

COUNTY OF LONDON.—TO ELECTRICAL ENGINEERS AND OTHERS.

The LONDON COUNTY COUNCIL invites TENDERS for the SUPPLY, DELIVERY, and ERECTION of FOUR SETS of HIGH-TENSION FEEDER and HIGH and LOW TENSION MACHINE SWITCHGEAR for its Tramway Sub-Stations at Battersea, Clapham, Streatham, and Wandsworth.

Persons desiring to submit Tenders may obtain the Specification, Drawings, Form of Tender, and other particulars at the County Hall, Spring Gardens, S.W., on payment to the Cashier of the Council of the sum of £2. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the Tenderer provided he shall have sent in a *bona fide* Tender and not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall previously to the payment of the fee for Specification, etc.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The Contractors will be bound by the contract to pay all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for High and Low Tension Sub-Station Switchgear."

No Tender will be received after 10 a.m. on Tuesday, the 11th day of July, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.
County Hall, Spring Gardens, S.W., June 16th, 1905.

BOROUGH OF NELSON.—SEWAGE WORKS.

The SEWAGE and STREETS COMMITTEE are prepared to receive TENDERS for the SUPPLY and ERECTION of a SUCTION GAS PLANT and ENGINE at the Sewage Works.

Particulars may be had on application at the Office of Mr. B. BALL, A.M.Inst.C.E., Borough Engineer and Surveyor.

Tenders, endorsed "Suction Gas Plant," to be sent to the undersigned by first post on Saturday, the 8th July, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

J. H. BALDWICK,
Town Hall, Nelson, Town Clerk.
June 9th, 1905.

METROPOLITAN WATER BOARD.—TENDERS for the SUPPLY of about 450 TONS of 42-in., 30-in., and other PIPES and CASTINGS.

The Metropolitan Water Board invite TENDERS for the SUPPLY of CAST-IRON PIPES and other CASTINGS, to be delivered at Cricklewood, in the County of Middlesex.

The Forms of Tender and Contract, with Specification and Schedule, may be obtained, and the drawings inspected, on application at the Office of the Board, The Firs, Southern Road, Fortis Green, East Finchley, between the hours of 10 and 4 (except on Saturdays), on and after Thursday, the 22nd instant, on production of an official receipt for the sum of ten guineas, which must first be deposited with the Comptroller at the Board's Central Offices, Savoy Court, Strand, W.C., which sum will be returned after the receipt of a *bona fide* Tender.

Tenders, endorsed "Cricklewood Pipes," enclosed in sealed envelopes, addressed to the undersigned, must be delivered at the above-named Central Offices, not later than 12 noon on the 7th July, 1905.

A. B. PILLING,
Clerk of the Board.

PAGE'S WEEKLY Contracts

METROPOLITAN BOROUGH OF SHOREDITCH.

ELECTRICITY SUPPLY DEPARTMENT.

The MAYOR, ALDERMEN, and COUNCILLORS of the Metropolitan Borough of Shoreditch require TENDERS for the EXTENSION of PLANT at their Whiston Street Generating Station.

The requirements include—

Two 1,500 kw. Steam Turbo-Generators.
Condensers, Pumps, Piping, etc.

Specification, drawings, and general conditions may be obtained on and after Tuesday, the 20th instant, at the offices of the Borough Electrical Engineer, Coronet Street, N., on payment, by cheque, of £5, which will be refunded on the receipt of a *bonâ fide* Tender. The fee will not, however, be returned until the whole of the Tenders received have been finally considered.

Tenders, sealed and endorsed (on the left-hand corner of envelope) "Tenders for Turbo-Generators," should be addressed to the Town Clerk, Town Hall, Old Street, E.C., and must be delivered not later than noon of the 18th day of July.

The Council does not bind itself to accept the lowest or any Tender.

H. M. ROBINSON, LL.D.,
Town Clerk.

Town Hall, Shoreditch.

TO BOILERMAKERS AND ENGINEERS.

The GUARDIANS of the HOLBORN UNION are prepared to receive TENDERS for SUPPLYING to and FIXING at their Workhouse, Western Road, Mitcham, Surrey, a NEW GALLOWAY STEAM BOILER; also for the execution of certain works in connection therewith, described in a Specification, which, together with a Form of Tender, may be obtained from the undersigned.

Sealed Tenders, endorsed "Galloway Boiler for Mitcham Workhouse," must be delivered to me at the undermentioned offices on or before Tuesday, the 4th July next.

The Guardians do not bind themselves to accept the lowest or any Tender.

By order,
J. ALLAN BATTERSBY,
Clerk to the Guardians.

Holborn Guardians' Offices, 53, Clerkenwell Road, E.C.,
June 15th, 1905.

COUNTY OF LONDON.—TO ELECTRICAL ENGINEERS.

The London County Council invites TENDERS for the SUPPLY, DELIVERY, and ERECTION at the Battersea and Wandsworth Electricity Sub-stations of the London County Council Tramways of two LOW-TENSION FEEDER SWITCHBOARDS.

Persons desiring to submit Tenders may obtain the specifications, drawings, form of Tender, and other particuars at the County Hall, Spring Gardens, S.W., upon payment to the cashier of the Council of the sum of £2. This amount will, after the Council or its committee shall have come to a decision upon the Tenders received, but not before, be returned to the Tenderer, provided he shall have sent in a *bona fide* Tender and not have withdrawn the same, but in no case will the fee be returned unless a *bonâ fide* Tender is submitted. Full particulars of the work may be obtained on application to the Clerk of the Council at the County Hall, previously to the payment of the fee for the specification, &c. Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with. The contractors will be bound by the contract to pay all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less, and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in, and form part of, the contract by way of schedule. Each Tender is to be delivered at the County Hall, in a sealed cover addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Low-Tension Switchboards—Sub-stations." No Tender will be received after 10 a.m. on Tuesday, the 11th day of July, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the Council.

County Hall, Spring Gardens, S.W.,
June 20th, 1905.

EAST INDIAN RAILWAY.—The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of

PIG IRON,

as per specification to be seen at the Company' offices.

Tenders are to be sent to the undersigned, marked "Tender for Pig Iron," not later than Twelve o'clock noon on Wednesday, the 5th day of July proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to aecept the lowest or any Tender.

For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
June 22nd, 1905.

APPOINTMENTS OPEN.

MINISTRY OF PUBLIC INSTRUCTION, EGYPT.

SCHOOL OF AGRICULTURE.

An INSTRUCTOR in LAND SURVEYING and FARM ENGINEERING is REQUIRED to begin work on September 30th in the School of Agriculture, Ghizeh (near Cairo).

Preference will be given to candidates having experience of practice and teaching. They should be from 23 to 33 years of age, unmarried, and have a robust constitution.

A University Degree or College Diploma is an essential qualification.

Salary about £295 per annum (£Eg. 24 per mensem), rising to about £393 per annum (£Eg. 32 per mensem). Allowance for passage out to Egypt. Bachelor quarters are provided.

Applications, with full statement of qualifications, and accompanied by copies only of testimonials, must be sent in before July 22nd, 1905, addressed to W. C. MACKENZIE, Esq., D.Sc., 5, The Crescent, Cromer, to whom candidates may apply for further information.

MINISTRY OF PUBLIC INSTRUCTION, EGYPT.

POLYTECHNIC SCHOOL OF ENGINEERING.

An INSTRUCTOR in ENGINEERING is REQUIRED, to begin work on September 30th, in the Polytechnic School of Engineering, Ghizeh (near Cairo).

The Instructor appointed will be engaged in teaching Descriptive Engineering and Hydraulics.

Candidates must have had practical experience as engineers, and have been engaged on work of a class intimately related to the subjects to be taught. They should be from 25 to 35 years of age, unmarried, and have a robust constitution.

A University Degree or Diploma in Engineering is an essential qualification.

Salary about £430 per annum (£Eg. 35 per mensem), rising to about £553 per annum (£Eg. 45 per mensem). Allowance for passage out to Egypt. Bachelor quarters are provided.

Applications, with full statement of qualifications, and accompanied by copies only of testimonials, must be sent in before July 22nd, 1905, addressed to W. C. MACKENZIE, Esq., D.Sc., 5, The Crescent, Cromer, to whom candidates may apply for further information.

CORPORATION OF DURBAN, NATAL.

APPLICATIONS are invited from Engineers to fill the post of BOILER SUPERINTENDENT in the Corporation Electric Power Station. The candidate must have had charge of a large installation of boilers, not under 5,000 horse power, in a central electric works, and must be thoroughly experienced in the construction of water-tube boilers. He should have had experience of mechanical stokers, and preference will be given to one who has been accustomed to working with a CO_2 tester.

The successful applicant will be placed in entire charge of a large battery of boilers under the direction of the chief works engineer Salary offered is from £250 to £300 a year, depending upon the qualifications which can be shown.

Applications, endorsed "Durban Boiler Superintendent," stating age and experience, together with copies (not originals) of not more than three recent testimonials, to be delivered to the undersigned on or before Tuesday, July 4th, 1905.

WEBSTER, STEEL, AND CO.,
Agents to the Corporation of Durban.

5, East India Avenue, London, E.C., June 15th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babeock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T, D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town London, E.

PAGE'S WEEKLY Wire Ropeways

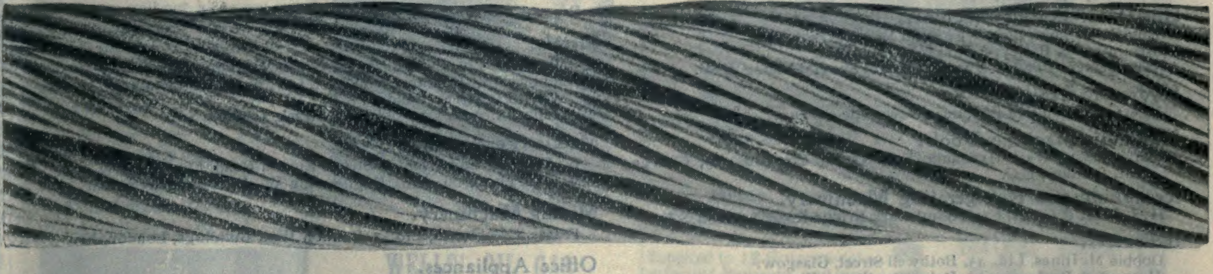
RESULT OF A TEST

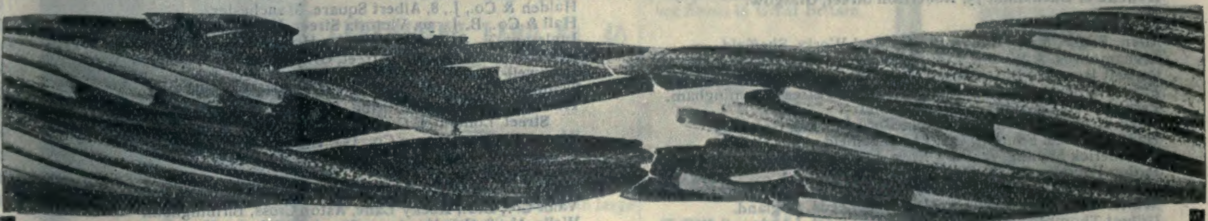
OF ONE OF

BULLIVANTS' STEEL WIRE ROPES

AFTER WORKING $3\frac{3}{4}$ YEARS.

This rope WHEN NEW measured $5\frac{1}{4}$ in. circ. and took a breaking strain of 104 TONS. SAME ROPE (STILL IN USE) after working continuously for $3\frac{3}{4}$ YEARS hauling heavy trains up an incline of 1 in 12, during which time it ran 58,000 MILES, and had reduced in size to $4\frac{7}{16}$ in. circ., WHEN TESTED took a breaking strain of 85 TONS 17 CWT.





WIRE ROPES FOR CRANES, LIFTS, HOISTS, DERRICKS, AND ALL PURPOSES.

BULLIVANT & CO., LTD.,

REGD. OFFICE: 72, Mark Lane, London. WORKS: Millwall, E.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mable, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd , Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co.. Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Méguin. Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co.. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.
Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

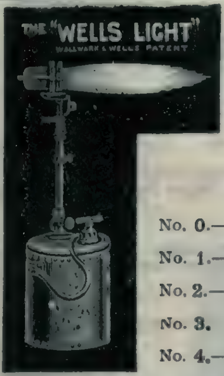
Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 20 Governments and all Leading Firms. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

OVER 18,000 SOLD

	PRICE COMPLETE.
No. **0.**—500 Candles, small hand pattern, for petroleum	£7 7 0
No. **1.**—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
No. **2.**—1,500 Candles, useful and portable pattern	£15 10 0
No. **3.** 2,500 Candles, Manchester Ship Canal pattern	£16 10 0
No. **4.**—3,500 Candles. A most powerful lamp...	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

No. 50 "STANDARD" LAMP.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints, Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/- each.
,, Double ,, ...	19/- ,,
Tripod Stands	3/- ,,
Extra Burners	2/- ,,

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 ,, ...	£30 0 0
No. 3 ,, ...	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS, Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

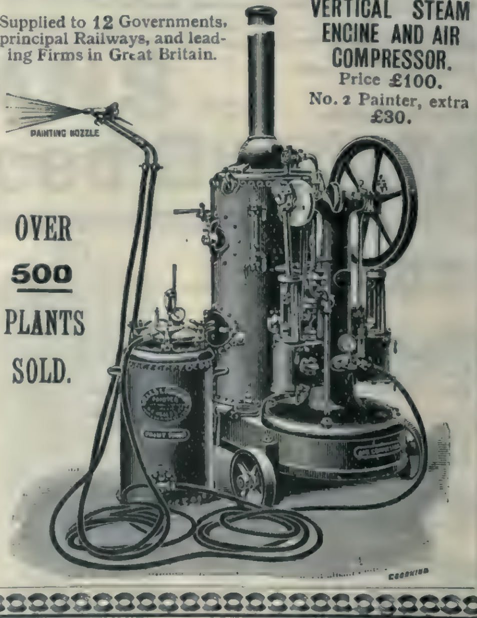
Price, Complete ... ... £16.

Hand Sprayer and Hose supplied separately, £9.

Supplied to 12 Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.
No. 2 Painter, extra £30.



OVER **500** PLANTS SOLD.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,
LONDON, N.W.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co. Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 75, Cannon Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
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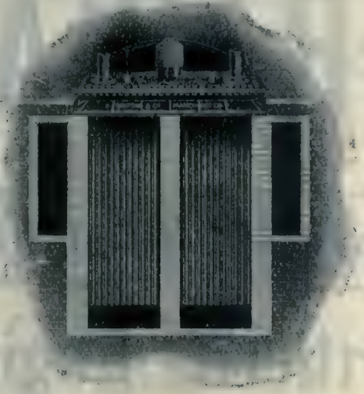

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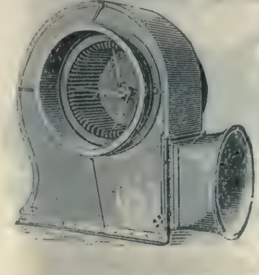

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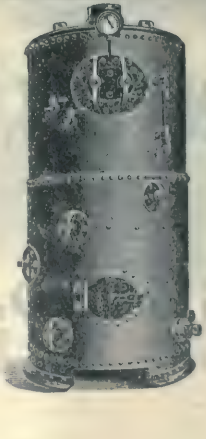

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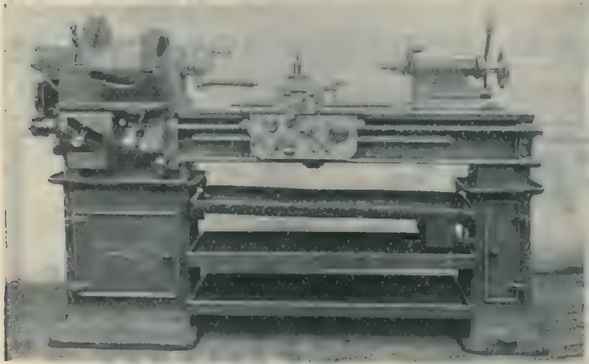

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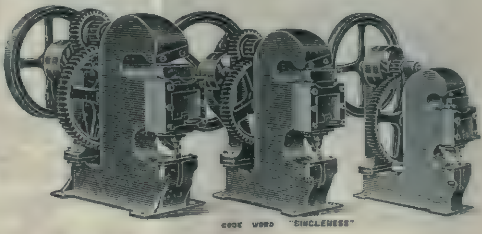

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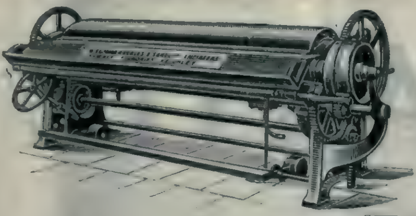

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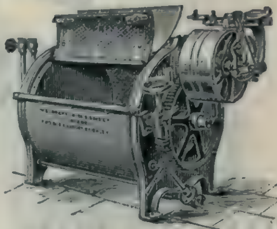

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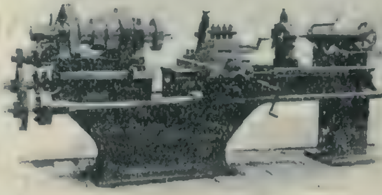

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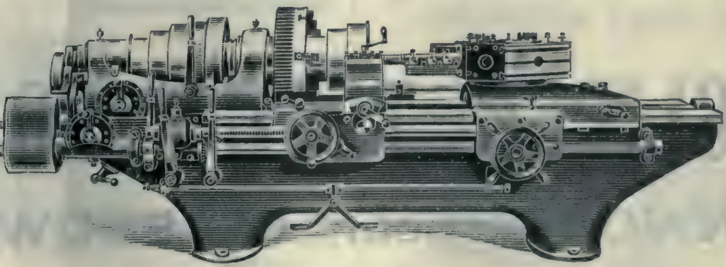

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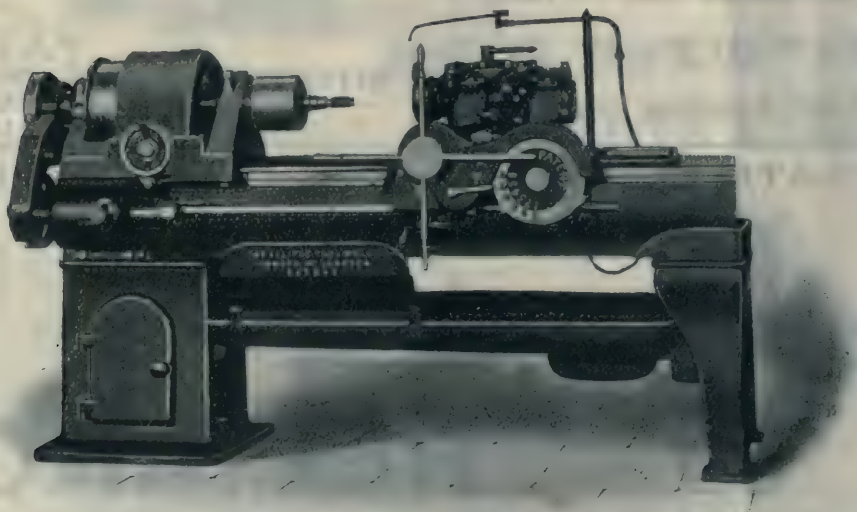

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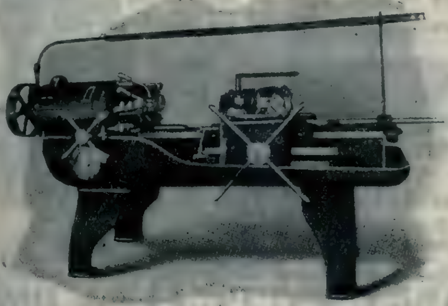

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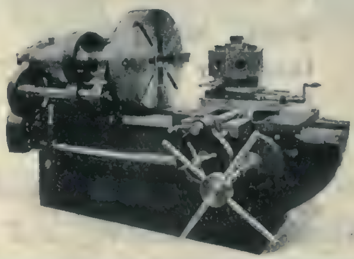

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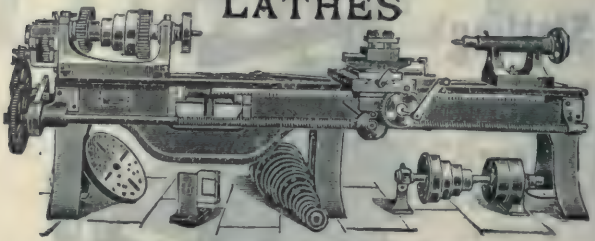

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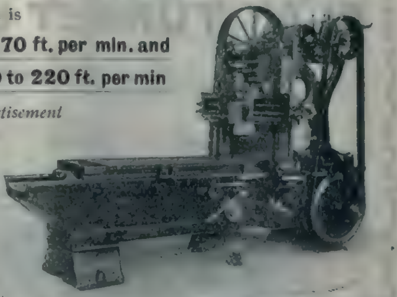

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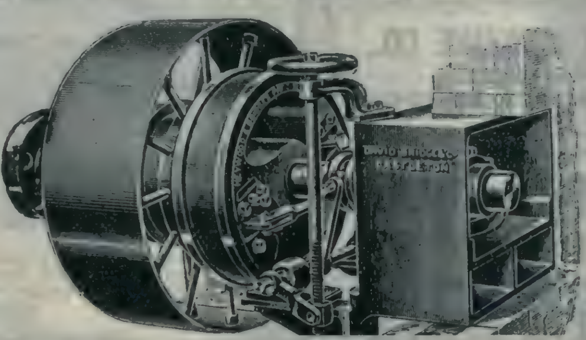

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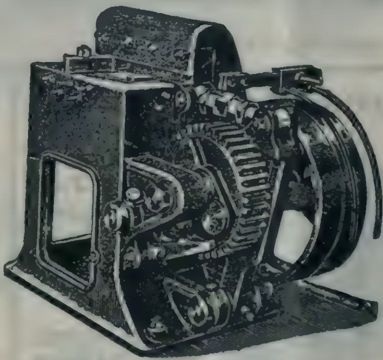

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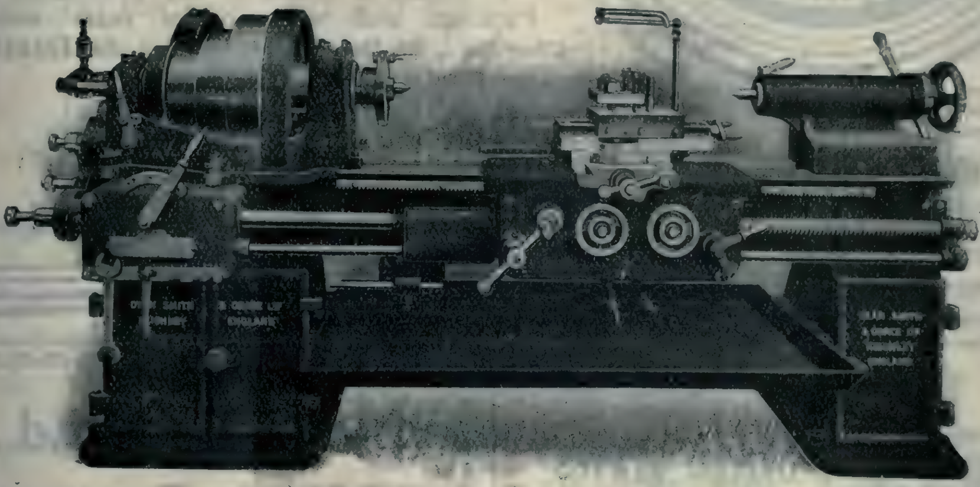

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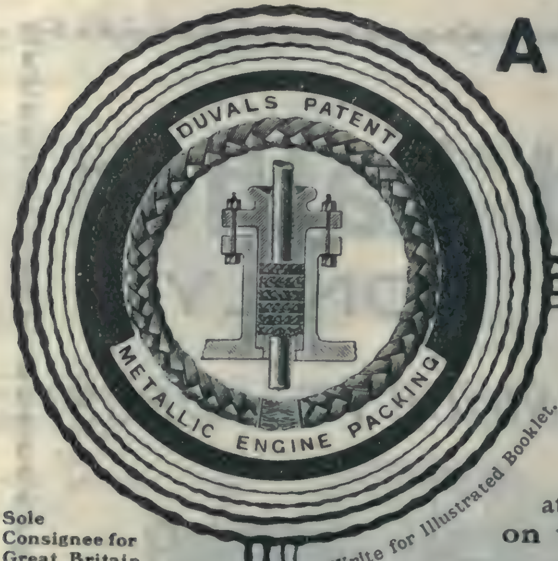

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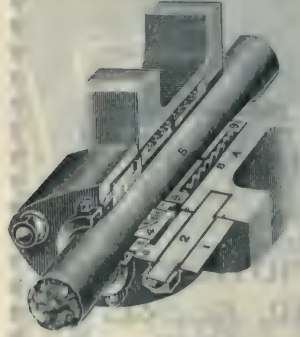

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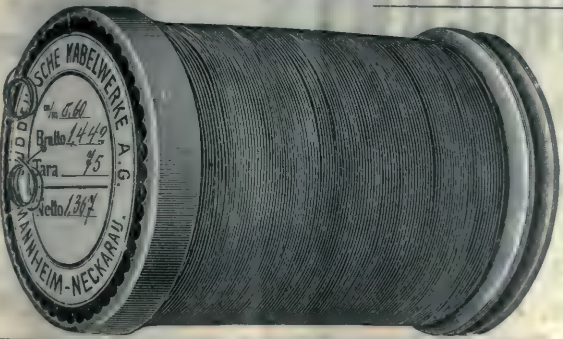

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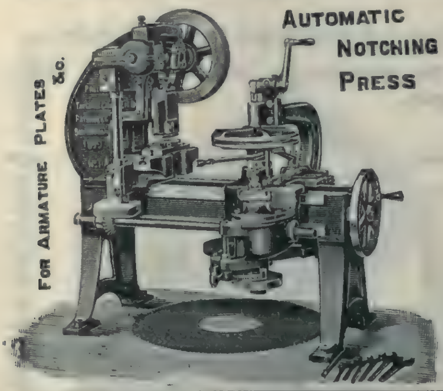

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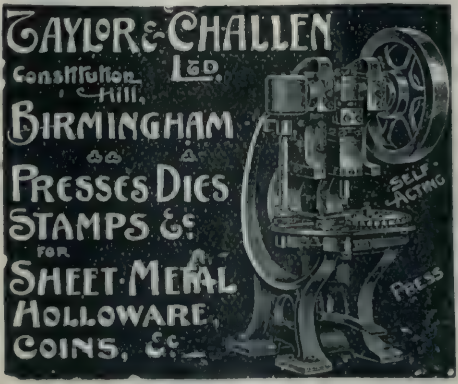

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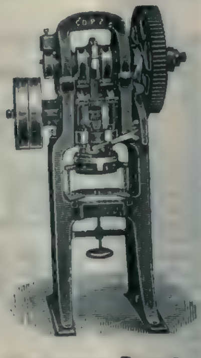

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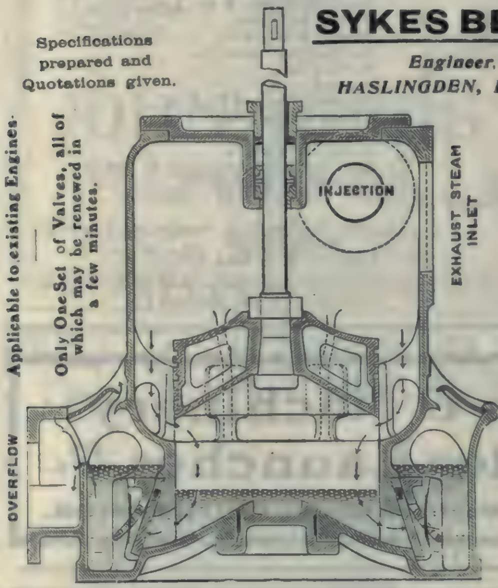

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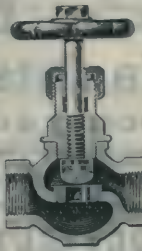

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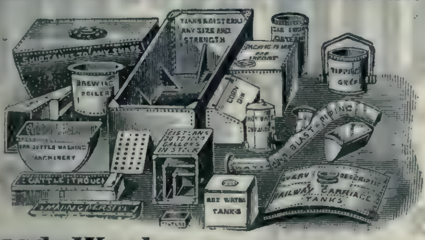
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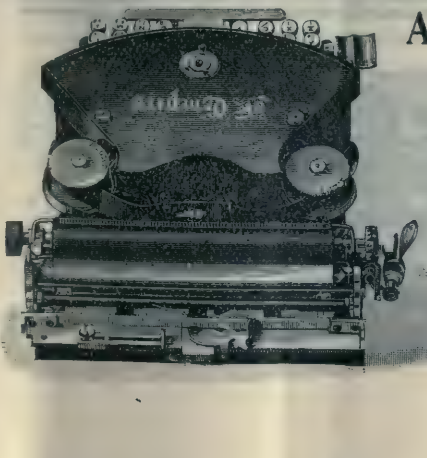

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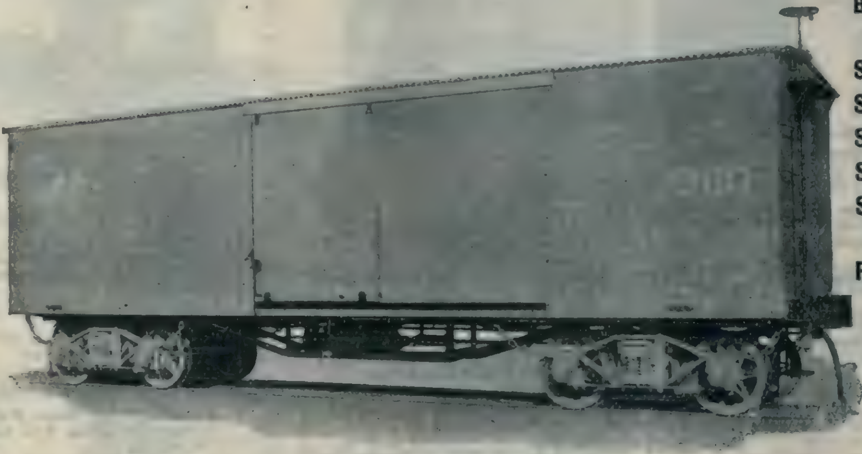

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, JUNE 30, 1905. NO. 42.

The Offices of "Page's Weekly," Wednesday Evening.

HEARTY congratulations to the Junior Institution of Engineers upon its coming of age. We have, however, heard the sentiment expressed very freely this week, so hasten to scan the summer meetings' proceedings for evidences of the wisdom which is supposed to accompany the assumption of the *toga virilis*. The first reflection which occurs to us on reviewing the history of the Institution is that it has spent an unconscionable time in the formulation of rules. It would appear that whenever the committee reached the proverbial "loose end" they fell back upon the rules and attacked them savagely. On one occasion, to quote Mr. Tennant's amusing history, they signalised their satisfaction with the progress of the Society by a positive "debauch of new rules." Doubtless it was felt that anything was better than a laissez faire policy, and that a constant striving to improve rules and regulations was bound sooner or later to bring the society out on top. It is regrettable for the credit of human foresight to add that Mr. Tennant in his history records an existing complaint that at least one of the rules (relating to the forwarding of papers to the secretary a month before reading) is still honoured only in the breach.

In many respects the Society has advanced with the characteristic impetuosity of a junior. It has left behind "'places of monastic aspect, and seats of lowly penitential character," and sits on state occasions in the seats of the mighty at the Guildhall. It can now produce an excellent record of work done, and deserves well of the technical world (if for no other reason) for having invented the "automatic bore extinguisher." This is started by the chairman at the commencement of each speaker's remarks and is arranged to give automatically an admonitory tinkle on a small bell five minutes afterwards. This arrangement presents all the advantages of Herbert Spencer's ear-stoppers without their exclusiveness. The benefits of the system, in other words, are common to all. We trust that the Junior Institution of

MR. W. H. LINDLEY, M.INST.C.E., F.G.S.,
President of the Junior Institution of Engineers.

Engineers may realise a long and honourable career, while ever maintaining that spirit of youthfulness which is characteristic of its members.

The following table received from the Right Hon. Thomas Andrews, chairman of the Belfast and County Down Railway, would seem to indicate that notwithstanding the keen endeavours which have been made by the Midland and London and North-Western Railways to capture the Irish trade, finality has not yet been reached in the journey between London and Belfast :—

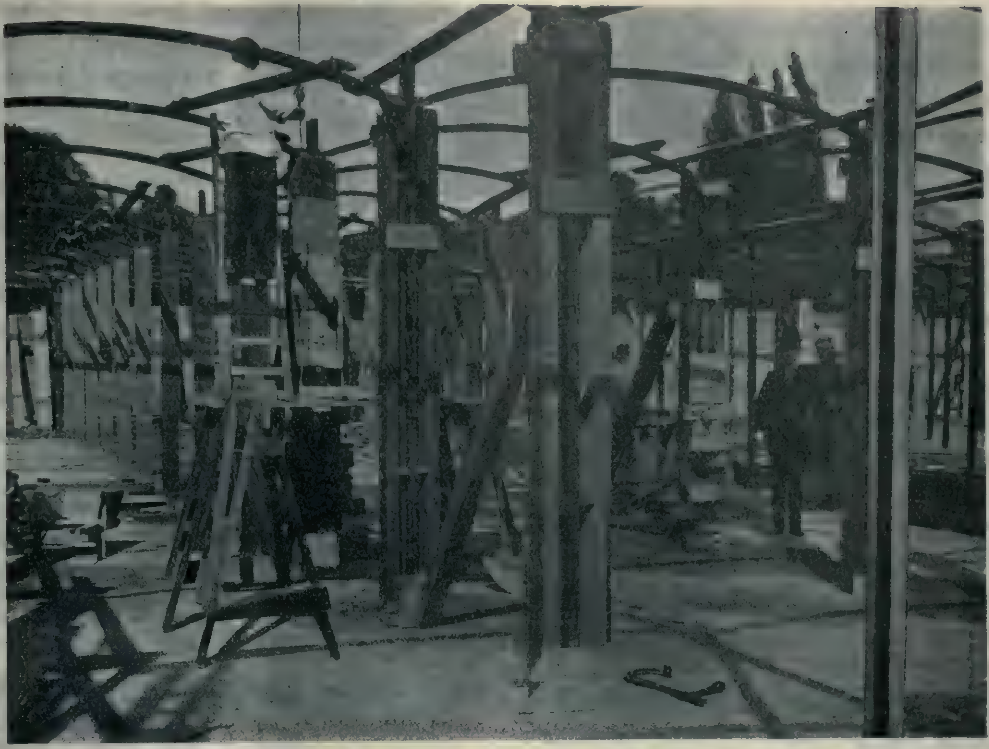
Route.	Particulars of Route.	Duration of Journey.		Distance Miles.
		Hrs.	Mins.	
Kingstown and Holyhead.	Belfast · dep. 5.0 p.m.			
	Kingstown ,, 8 15 ,,	3	15	118
	Holyhead ,, 12.22 a.m.	4	7	66
	Euston arr. 6.10 ,,	5	48	264
		13	10	448
Larne and Stranraer.	Belfast dep. 5.30 p.m.			
	Larne Hr. ,, 6.20 ,,	—	50	21½
	Stranraer ,, 9.8 ,,	2	48	40
	Euston arr 7.35 a.m.	10	27	407
		14	5	471½
Greenore and Holyhead.	Belfast dep. 6.45 p.m.			
	Greenore ,, 8.20 ,,	1	35	57
	Holyhead ,, 2.0 a.m.	5	40	80
	Euston arr. 7 30 ,,	5	30	264
		12	45	401
North Wall (Dublin) and Holyhead.	Belfast dep. 5.0 p.m.			
	Dublin ,, 9.20 ,,	4	20	115
	Holyhead ,, 2.0 a.m.	4	40	70
	Euston arr. 7.30 ,,	5	30	264
		14	30	449
Fleetwood ...	Belfast dep. 9.15 p.m.			
	Fleetwood ,, 6.5 a.m.	8	50	[illegible]40
	Euston arr. 10.50 ,,	[illegible]	45	229
		13	35	369
Liverpool	Belfast dep. 8.0 p.m.			
	Liverpool ,, 8.0 p.m.	12	[illegible]	156
	Euston arr. 12.0 noon.	4	0	201
		16	[illegible]	357
Heysham	Belfast dep. 9.0 p.m.			
	Heysham ,, 5.15 a.m	8	15	140
	S. Pancras arr. 11.20 ,,	6	5	270 approx.
		14	20	410
		Hrs.	Mins.	
Killough and Holyhead.	Belfast dep. 8.10 p.m.			
	Killough dep. 9.10 ,,	1	[illegible]	33
	Holyhead dep. 2.0 a.m.*	[illegible]	50	77
	Euston arr. 7.30 ,,	[illegible]	30	264
		11	20	374

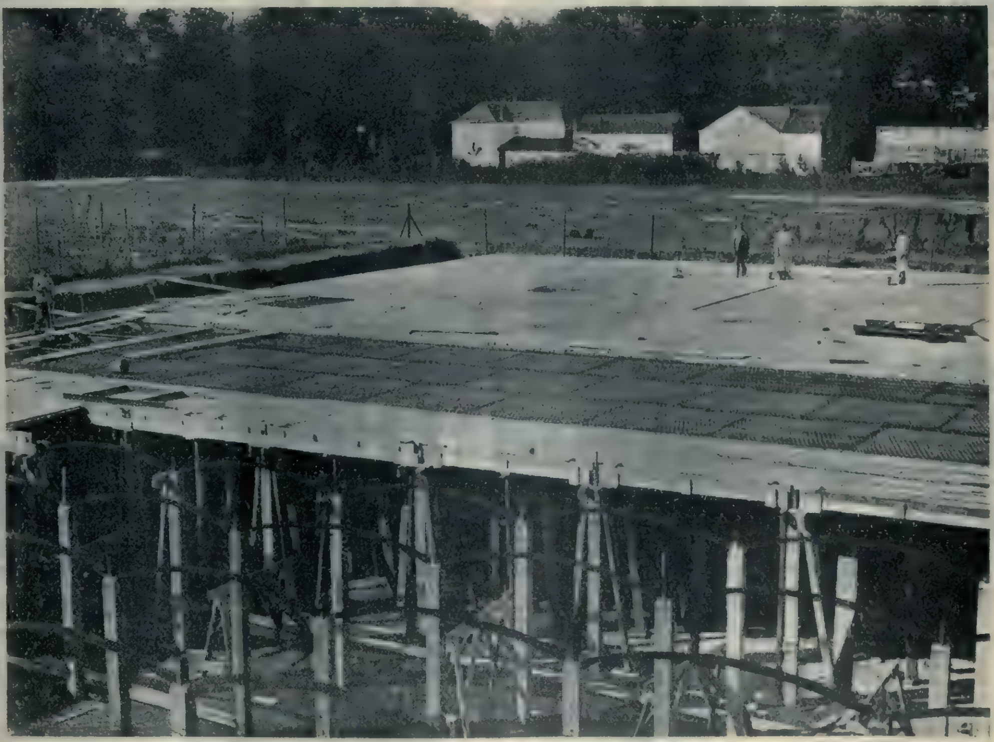
* Same speed as via Kingstown

It is once more pointed out that by utilising Killough harbour a saving of from one hour and twenty-five minutes to three hours, might be effected. A contemporary mentions certain surveys and borings made at Killough, but we are able to state that no improvements are at present projected. If, however, one of the large English railway companies contemplated adopting the route referred to, improvement of Killough harbour would necessarily form part of the scheme. The harbour is of mud, and it is stated that it could be made efficient without much trouble or expense, being merely a matter of dredging.

Last week we described the awkward experience of Mr. Charles Francis de Nevers, A.M.Soc.C.E., in the exploitation of ore deposits in Russia and Siberia. "This," he writes, is not an isolated experience, for, to my personal knowledge, the same thing has happened eleven times in the last two years. The Russian officials will encourage foreign capital to establish a plant, and then, on one pretext or another, they will seize the plant, and, so far as they are able to, exploit it themselves. If you object, they put you in prison, and are not slow to use the knout and to confiscate your personal property on the fallacious pretext of political reasons. I am preparing a detailed report which will give exact data as to the chance of foreign investments in Russia and Siberia. But in the meantime, I would advise everyone intending to do business there to take great precautions." Incidentally he mentions that he visited General Kuropatkin's camp several times last November, and could easily understand the reason why the mighty Russian army was invariably badly beaten by the Japanese. Every time he was there he saw drunken men everywhere; soldiers and officers alike were absolutely incapable of acting.

The London correspondent of the Glasgow Herald writes: The order for the turbine machinery for the new battleships which are to be built at Portsmouth Dockyard has been placed with the Vickers Company. This is the first set of turbine machinery for any warship





STEEL AND CONCRETE CONSTRUCTION AT THE ANTWERP WATERWORKS (*See page* 1394.)

of large size, the power being about 23,000 i.h.p. As in the case of the large Cunard liners there will be four shafts each with go-ahead turbines, so that there will be two high-pressure and two low-pressure turbines. There will also be a separate turbine in each shaft for driving the ship astern. In this warship there will be additional turbines, so that economy may be assured when running at low power. Under such conditions the arrangements will approximate to those attained with quadruple expansion engines, as it will be possible to pass the steam through three or four turbines successively before it enters the condenser. Thus, for very low powers, the four-turbine arrangement will be used, for intermediate powers the triple compound arrangement, but at full speed the full boiler pressure will be passed into the main turbines direct, the smaller cruising turbines running idle. The steam pressure at the boilers will be higher than in preceding turbine installations, and this is likely to add greatly to the economy. Babcock and Wilcox water-tube boilers will be used. As is now pretty well known, it is proposed to create a record in the building of this machinery and of the ship itself, and heavy penalties are attached to late delivery. With their great resources, however, the Vickers Company are pretty certain to meet the high demands laid upon them.

There is considerable misapprehension (we quote from a recent paper by Mr. Tom Westgarth) as to the quantity of gas, oil, and cooling water used by large gas engines. These engines can run with about 100 cubic feet of Cleveland blast furnace gas per brake horse-power per hour. If producer gas is used the consumption is about 76 cubic feet, and of coke-oven gas about 32 cubic feet. The consumption of oil is not excessive; in the case of the engine at Summerlee not more than 5 gallons per twenty-four hours. Part of the oil is filtered and used again, and "special Mazout" oil, costing about 9d. to 10d. per gallon, runs well; a few pounds of Stauffer grease is also required. The water for cooling the jackets, pistons, etc., is about 12 to 14 gallons per brake horse-power per hour of cold water; this can be cooled and used again the loss by evaporation being not more than about 3 per cent.

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PAGE'S WEEKLY

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Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, JUNE 30. — Royal Colonial Institution, Conversazione: Natural History Museum, Cromwell Road, S.W.—Canadian Manufacturers Association visit Bradford.

MONDAY, JULY 3. — Electrical Tramway and Railway Exhibition, Agricultural Hall.—Canadian Manufacturers visit Liverpool. —International Mining Congress at Liége.

TUESDAY, JULY 4.—Society of Arts, Conversazione at Royal Botanic Society's Gardens.—Canadian Manufacturers at Newcastle.—Municipal Tramways Association: Annual Conference at Agricultural Hall.

WEDNESDAY, JULY 5. — Canadian Manufacturers in Edinburgh.—Institution of Civil Engineers, Annual Conversazione.

NEWS ITEMS.

Mr. G. Moncur, B.Sc. A.M.Inst.C.E., has been appointed to the Lectureship in Civil Engineering at the Glasgow and West of Scotland Technical College,

It is reported that the Russian Government contemplates the construction of a large harbour in the Black Sea at Touapse, a town situated 70 miles from Novorossisk.

Attention is called to the revival of the project to connect Prince Edward Island with the mainland by a tunnel four miles long. It is believed that the plan will now be carried out.

It is estimated that the deepening of the Manchester Ship Canal by two feet in the Cadishead section, which is now in progress will occupy two years, there being more rock to be contended with than in any other section.

A contract has been concluded by the Board of Trade and Trinity House with Marconi's Wireless Telegraph Company, Ltd., providing for the equipment of lightships with Marconi wireless telegraph installations.

An exhibition of practical work executed by students of technical classes in the United Kingdom and the Colonies and by students at the 1905 examinations of the City and Guilds of London Institute, is being held at the Imperial Institute (North Gallery), and will be continued until July 8th.

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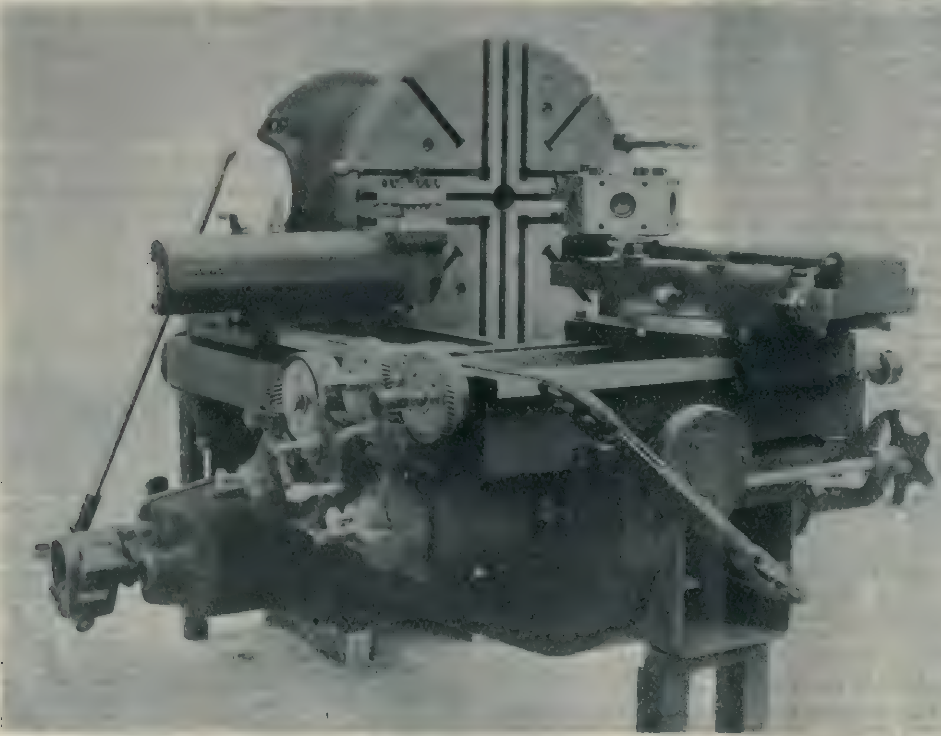
"Institution of Mining and Metallurgy."

Professor Henry Louis contributes the following to the Bulletin of the Institution of Mining and Metallurgy. "In connection with Mr. French's paper on Ore Sampling (Bulletin No. 8, p. 9) it may be of use to draw attention to a very convenient method of sampling either in the field or in the laboratory, which appears to be very little known in this country; I first saw it in use in Sweden and have used it myself a good deal with perfectly satisfactory results. The appliances consist of three troughs, V-shaped in cross section and open at both ends, the angle at the apex being 90 deg. Dimensions depend upon the material being treated; for field work and large parcels broken say to 1½ in. ring, troughs made of pieces of 10-in. board, 4 ft. long held together by a few nails, answer admirably. For laboratory work I use pieces of stout sheet zinc or tinplate, 12 in. long and 6 in. wide, bent up lengthways, so that each side is 3 in. broad. To use this appliance, one of the V-shaped troughs is placed horizontally, apex upwards, on two sheets of American cloth or canvas, or over two boxes; another trough is placed, apex downwards, over the first one, inclining towards it at an angle of 30 deg. or 40 deg., the lower end resting on the centre of the apex of the lower one; the third trough is placed above the second in zig-zag fashion, and similarly inclined, its lower end delivering material at the top end of the second trough. Thus, any material poured down the top trough runs fairly into the second, and then falling on to the apex or edge of the first, is divided into two equal parcels. The operation is very rapid, and may be repeated as often as is required, until the sample is reduced to the requisite size. The appliances are simple in the extreme, may be improvised almost anywhere, and if the troughs are made of two hinged pieces, are very portable. The few tests that I have made have shown that this simple method seems to be as accurate as any other, but it would be very desirable that Mr. French should include this device amongst his tests. In any case he, as well as other members, may be glad to know of this simple sampling device."

The following members have been admitted to the Institution since May 11th, 1905:—R. Hay Anderson, Mexico; J. Parke Channing, New York; Charles P. Durell, Colorado; Frank Klepetko, New York; James W. Malcolmson, Texas; J. Othon Mayen, Paris; B. Stanley Revett, Colorado; Edwin



THE BULLARD VERTICAL LATHE. (*See page* 1404.)

M. Rogers, New York; Edmund J. Spilsbury, New York; Thomas Trevaillé-Williams, Cornwall.

Messrs. Frederick Blamey, Francis W. Smith, Assoc. R.S.M., and Arthur Blamey, Student Inst.M.M., are leaving London for Egypt in the service of the Egyptian Mines Exploration Company. Mr. Anthony Southee, Assoc.Inst.M.M., has been appointed Manager of the Djebel Charra Mines, par Béja, Tunis. Mr. G. A. Wagner, Assoc. Inst. M.M., has vacated the position of Superintendent to the Caylloma Silver Mining Company, Ltd., and has been appointed General Manager of the Colquipoaro Mines on the Cordillera Negra, in the interior of Peru.

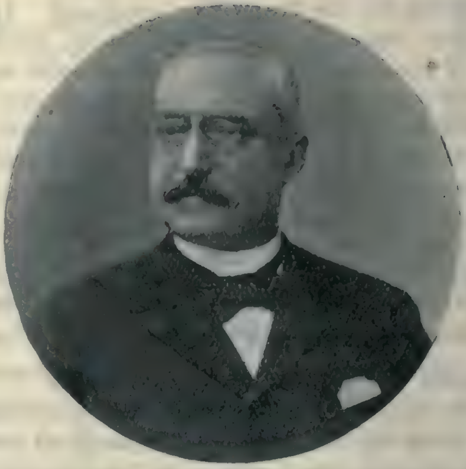
Bolivia as a Tin Producer.

Referring to the increase in the production of tin, H.M. Consul at Oruro (Mr. J. Ramsay Smith) reports that only a few years ago the exportation of this metal was so insignificant that but few people in the United Kingdom knew anything about it, and some of these few thought it came from Chile, as it was shipped from a Chilean port. To-day Bolivia is one of the largest tin producers in the world, and half the output comes from the Oruro district.

International Congress at Liege.

Immediately following the summer meeting of the Institution of Electrical Engineers, at Liége, comes the International Congress of Mining, Metallurgy, Mechanics, and Applied Geology. A strong committee has been formed consisting of MM. J. Magery, president; H. Dechamps, general secretary; Paul Habets, assistant secretary; René Henry, secretary for the Mines Section; Constant Renson, secretary for the Metallurgical Section; Georges Duchesne et Pouleur, for the Mechanical Section; and René d'Andrimont, for the Section of Applied Geology. The Congress, which extends over eight days, promises to be of a very interesting and representative character, as in addition to Belgium, France, Japan, Roumania, Austria, Denmark, and Italy, the United States, Holland, and the Congo Free State will be officially represented. The programme includes visits to the Cockerill works, to the Hasard colliery, the Grand-Hornu, the Bois-le-Duc, and the collieries of l'Espérance and Bonne-Fortune and Patience and Beau-jonc. A prominent item in the programme is a monster banquet at the Renommée Hall.

The news of the death of Mr. Archibald P. Head, who was one of the victims of the railway accident at Painesville, U.S.A., has been received with great regret. Although he was senior partner in the firm of Jeremiah Head and Sons, of Westminster, Mr. Head was a comparatively young man.



M. JULES MAGERY.

M. HERMAN HUBERT.

M. ADOLPHE GREINER.

Prominent Members of the International Congress at Liege.

Linking up the Trams.

The House of Commons Committee which has been considering the County Council's Bill for the construction of tramways over Westminster and Blackfriars Bridges, on Thursday accepted a clause, submitted on behalf of the City Corporation, providing that no part of the proposed tramways shall be commenced until either Blackfriars Bridge has been widened by the Corporation or a bridge has been constructed to carry the tramways across the Thames. The chairman expressed confidence that the Corporation meant to widen the bridge.

Causes of the Russian Naval Disaster.

The causes of the Russian naval disaster are summed up by M. Olginski, the correspondent of the Novoye Vremya, at Harbin, as follows: (1) Since the 25th May, by the Admiral's order, no more attempts were made to upset the Japanese correspondence by means of the wireless telegraph, so that the enemy were well informed as to our movements and we in the dark as to theirs. (2) The narrowness of the strait and the rapidity of the Japanese ships permitted them to divide their squadron, and to attack us on three sides simultaneously. (3) Our fleet at the moment of attack, though it had been practising formations constantly, took up one that only permitted the use of a portion of its guns. (4) The transports were most difficult to deal with. They destroyed the order of combat, and when they came under fire fell into disorder. (5) Neither the admirals nor captains knew what were Rojdestvensky's intentions. He only saw Niebogatoff once for a quarter of an hour after the junction of the fleets. From this arose the confusion when he was wounded. (6) Our fire was wild and very inferior to that of the Japanese. For some months there had been no target practice. Only three rounds per piece of the 12-in. guns had been fired at Madagascar. (7) The crews were exhausted, men are not machines, and eight months of incessant nervous strain in a tropical atmosphere had worn them out. (8) The great number of Japanese torpedo boats, and the floating mines which blew up when touched by the ships. Thus perished the *Borodino*, *Admiral Nakhimoff*, and *Navarin*. (9) Immense superiority of the Japanese gunnery. The enemy concentrated his fire on the big ships, and transferred it from one to another in succession. Thus were sunk the *Osliaba*, the *Alexander III.*, and the *Suvaroff*. (10) The Japanese being in "line of front" (*sic*) at the commencement of the battle, had the superiority of fire. All their ships, nearly all their guns, and even quick-firing guns were in action. With us, on the contrary, only the fire of the leading ships could at first be utilised, and many of our guns could not fire for fear of hitting our transports. (11) The *Osliaba* sank without a single injury below the waterline. The sea rushed into the holes made by the Japanese shells as she rolled. She listed more and more and then sank. (12) Want of unity of type of ships and slow speed were the causes of the loss of the *Monomakh*, *Ushakoff*, and *Senyavine*. They were left behind and surrounded. (13) On the second day ammunition ran short.

The New Explosive "Axite."

A demonstration was given on Tuesday at the works of Messrs. Kynoch, at Witton, near Birmingham, with the new smokeless powder axite.

We quote the following from the *Times*: "To illustrate the properties of the powder a series of experiments were carried out with military and sporting rifles. To prove the absence of risk of damage to the barrel by the use of axite, it was shown that a rifle from which ten rounds had been fired twenty hours previously, and which had been laid aside untouched, remained uninjured. The next experiments were designed to demonstrate the advantages attainable by the use of axite in combination with a more modern breech action than that of the service rifle. A number of ·375–·303 axite cartridges with 200 grain bullets fired from a rifle with Mauser action gave a mean velocity of 2,726 f.s. with a pressure of 20·95 tons, and when a 215 grain bullet was used, the velocity was 2,498 f.s. and the pressure 19·24 tons. Similar experiments with a service ·303 rifle gave with axite a velocity of 2,179 f.s. and a pressure of 15·76 tons, and with cordite 2,010 f.s. and 15·67 tons; with the axite, however, a larger charge was required, about 34½ grains against 31½ of cordite. Samples of axite and of cordite were next heated to 110 deg. for an hour and tested for pressure; the former gave an increase of 6·1 per cent. and the latter of 9·8 per cent. The next experiments had to do with trajectories over a range of 500 yards. While the mean height at 280 yards above the line of sight was with five ·303 service cordite cartridges 41·58 in., it was with ·303 service axite 35·4 in., with ·375–·303 axite and 215 grain bullets 26·94 in., and with ·375–·303 axite and 200 grain bullets 22·37 in. A temperature of explosion test yielded the result that after ten consecutive rounds at ten seconds' intervals the temperature of the barrel rose to 71 deg. with axite and to 89 deg. with cordite. The lubricating action of axite was illustrated by firing three cordite cartridges from a ·303 rifle, followed by one axite cartridge and then by another cordite cartridge; the increased average velocity of the last cordite cartridge as compared with the first three was measured as 97 f.s.

The Royal Agricultural Society Show.

THE third successive exhibition of the Royal Agricultural Society at Park Royal opened on Tuesday last, and it altogether depends upon the financial results of the present exhibition whether the show is to find a permanent home at Park Royal or if the old custom of holding it at a different centre each year is again to be resorted to. There is, of course, something to be said in favour of the acquisition of a permanent show yard, and the foundation of Park Royal was really an attempt on the part of those controlling the Royal Agricultural Society to adapt themselves to new conditions and requirements. It was felt that the success of the "Royal" during past years had produced local organisations which sufficiently served the requirements of particular districts. Growing urban populations had also rendered increasingly difficult the discovery of suitable sites of adequate extent for the Royal Show. It was these and other causes which induced the Council to abandon the migratory system.

One disturbing feature since the show was permanently held at Park Royal has been the marked decline in the applications for space in the department of implements, machinery, and miscellaneous exhibits. The entries in this section number 3,854 as compared with 4,419 last year, and 5,524 in 1903, and, as a matter of fact, with one exception, the entries under this head are the smallest for forty-five years. It would appear that the falling off in entries is due to decline in business done by machinery makers, who found better opportunities for enlarging their list of customers when the show was migratory.

However, notwithstanding the decline in the number of exhibitors there is much in this section which calls for notice, and some of the best-known firms in the country are among the exhibitors. Hadfield's Steel Foundry Company are exhibiting their stone crushing, screening and elevating plant, the faces of the stone crusher being of "Era" manganese steel. Thomas Robinson and Son, Ltd., of Rochdale, exhibit a good many varieties of their well-known manufactures. The Fairbanks Company's stand has attracted a good deal of attention with its oil engines and pumps and weighing machines, and in the same class of exhibit the Campbell Gas Engine Company are showing their improved design engine, both portable and horizontal types. Hunt and Mitton are exhibiting engine and boiler fittings for portable, traction and motor engines, and appliances for all kinds of agricultural machinery. The S. Howes Company display new implements in the churn class to which special attention may be directed. An important stand is that of W. and T. Avery, Ltd., of Birmingham, who are exhibiting a new type of motor traction platform, which we shall describe and illustrate in our next issue. Reference may also be made to the exhibits of W. H. Willcox and Co., and those of Clayton and Shuttleworth, Ltd. Among the big firms the stand of Babcock and Wilcox, Ltd., contains an interesting exhibit in the shape of a water-tube boiler-model fitted with patent steam superheater. The other exhibits include models of a mechanical stoker, turbine tube cleaner, and samples of boiler parts. John Fowler and Co., of Leeds, have some excellent exhibits in the class of road locomotives and ploughing engines, and J. and H. McLaren also exhibit ploughing machines and agricultural locomotives, one of 8 h.p. being fitted with compound cylinders and with the McLaren improved spring gear on both axles. Merryweather and Sons, Ltd., is another firm whose stand has attracted attention. Detailed notices of some of these exhibits will appear in our next issue.

THE COMING OF AGE SUMMER MEETING OF THE JUNIOR INSTITUTION OF ENGINEERS.

1884 JIE 1905

WE have already had something to say in PAGE'S WEEKLY about the coming of age of the Junior Institution of Engineers, and it is now our privilege to chronicle the holding of their summer meeting in London. The Institution had not only the advantage of meeting in the historic Guildhall, but the Lord Mayor and Sheriffs attended in state to do the honours.

Members attending the meeting included the following —

(Prof.) H. Adams, Robert Baker, (Sir) John Wolfe Barry, G. I. Bergmans, E. Biliotti, F. Biliotti, (Sir) Alexander R. Binnie, John F. Black, J. N. Boot, James Boot, W. J. Bowtell, Bernard Brooks, G. Brooks, George Bullock, S. Bylander, Hugh Calder, George Canning, H. W. A. Carter, G. C. Carley, C. B. Chabot, Frank W. Clark, H. D. Colly, William J. Cooper, Charles E. Cotton, A. Knight Croad, Samuel Cutler, Junr., W. H. DeRitter, Martin DeVille, W. A. Dickson, Goland B. Dobson, Ernest A. Dowson, A. J. Dyer,, F. W. Dunn, W. T. Dunn, F. R. Durham, E. Eade H. R. Edwards, O. G. Edwards, Cecil J. Evans, John C. Fell, L. de M. G. Ferreira, Edward Flex, W. Fendick. A. F. M. Gatrill, Ernest A. Garratt, A. R. Gibbs, (Dr.) R. T. Glazebrook, H. T. Gould, H. Norman Gray, W. H. Gray, Joseph Green, F. B. Griffith, Frank P. Hailey, Albert E. Harris, Cyril A. Hart, Edward Haynes, C. F. Hill, A. H. Huddart, Arthur M. Hughes, George H. Hughes, Stanley G. Hughes, D. N. Hunt, Adam Hunter, J. W. Hunter, Clarence J. Inder, R. Graham Keevil, (Dr.) A. B. W. Kennedy, B. E. Dunbar Kilburn, C. H. Kilminster, H. E. Kennard Benjamin T. King, Ernest King, G. P. Knowles, E. Norman Lawley, J. R. d'O. Lees, Clement Lean, W. E. Lilly, F. E. S. Lindley, W. H. Lindley (President) J. W. Lloyd-Jones, R. P. Locke, C. Loughborough, W. J. Bassett Lowke, G. E. Lyddon, William D. Macpherson, Percival Marshall, A. W. Marshall, R. Marshall, E. J. L. Mears, F. W. Mellowes, R. A. Miles, A. W. Mills, A. Mitchell, Frank Mitchell, Percy Mitchell, J. Fletcher Moulton, F. D. Napier J. W. Newton, J. W. Nisbet, George Oliver, James Oswald, John Oswald, Junr., Charles E. Oxbrow, Frank H. Page, L. Parnham, H. E. Parker, J. H. Pearson, Alfred E. Penn, Loftus Patton Perkins, (Dr.) John Perry, Gaston R. de Peyrecave, Harold P. Philpot, Arthur G. Pitt, William L. Powrie, William Powrie, C. H. Prichard, (Col.) Edward Raban, Charles P. Raitt, Henry Ramsay, L. M. Rampal, Julian A. Roberts, James Rennie, H. J. Rickwood, F. C. Robus, E. C. Roche, E. D. Roberts, Edwin B. Roscoe, Arthur Ross, Junr., Lewis H. Rugg E. Milford Rusk, H. R. Sanders, Fred H. Seager, Alex. Siemens, Alex. J. Simpson, Henry C. Sims, Charles H. Smith, Montague H. Smith, A. H. Stanley, Percy A. Spalding, W. H. J. Stevens, C. Stevens, A. E. Taylor, Francis R. Taylor, W. J. Tennant, T. G. Howes Thomas, W. A. Tookey, W. Vincent Treeby, B. T. Trevett, W. P. Turner, (Professor) William C. Unwin, H. B. Vorley, Stanley C. Waddington, Charles J. Wawn, Arthur G. Way, (Sir) William H. White, Harry Whittaker, A. B. Williamson, John W. Wilson, Harold E. Yarrow, Algernon G. Young, D. S. Young, H. J. Young, Percy L. Young.

We are not prepared to assert that all the above members were present at the opening meeting, but it may be safely said that the number of ladies gracing the proceedings was distinctly larger than that which usually falls to the lot of technical meetings.

MUNICIPAL AND OTHER COURTESIES.

The Lord Mayor, amid all the pomp and circumstance of civic authority, bade the Association welcome, and added his good wishes for the success of the meeting.

The President of the Institution, Mr. W. H. Lindley, M.Inst.C.E., F.G.S. (Frankfort-on-Maine), was the better able to appreciate and acknowledge these municipal courtesies, as on the previous Friday afternoon he was in a Russian city, and doubtless the contrast in the externals of municipal life was a very strong one.

A vote of thanks to the Lord Mayor and Sheriffs having been duly carried by acclamation and responded to by the Senior Sheriff, a number of representatives of kindred societies were received by the President, having attended to offer coming-of-age congratulations.

Dr. A. B. W. Kennedy speaking on behalf of the representatives, said he had all the more pleasure in doing so as he had the honour of being one of the first presidents of the society. He congratulated them heartily on the success of the Institution, and paid a warm tribute to Mr. T. W. Dunn in his capacity of Secretary.

A short address by the President followed, in the course of which Mr. Lindley expressed the hope that the twenty-first year of the institute would witness its incorporation.

This being the eightieth birthday of Lord Kelvin, a telegram was dispatched expressing the sincere congratulations of the meeting. Lord Kelvin is one of the Vice-Presidents of the Society.

RISE AND PROGRESS OF THE INSTITUTION.

Mr. W. J. Tennant, past Chairman, proceeded to read extracts from a very interesting account of the Institution's history compiled by himself. An abstract follows :—

The Institution had its origin during the early part of 1884 in the works of the world-famous but now defunct firm of Maudslay.

Amid the best features of modern engine design, in this quaint old establishment thus dignified by association with many of the great mechanics and notable mechanical achievements of the past, the founders of the Institution began their professional training, in the course of which they developed, at the instigation of Mr. S. H. Wells (past Chairman A.M.Inst.C.E., Wh.Sc.), now principal of Battersea Polytechnic, the Vulcanic Society, which continues its life as the Junior Institution of Engineers.

The first meeting of the Vulcanic Society took place on June 30th, 1884, with Mr. P. H. May as chairman and secretary. It evolved a set of rules.

The second and succeeding meetings were concerned in part with the reading of professional papers, and, moreover, were nearly all characterised by alterations of the rules, in spite of which the society steadily flourished. (Laughter.) At the sixth meeting, held on September 15th, 1884, a further alteration of rules changed the name of the society to "The Lambeth Junior Scientific Society."

The twelfth meeting, on December 16th, 1894, was held in the mess-room at Maudslay's. Such an important improvement in the arrangements could not be suffered to pass unmarked, and accordingly the members elected Mr. Freke Field as the first President, and sacrificed the original rules, indulging in a new set, of which the first clause confirms the resolution of the sixth meeting as to the title of the society, succeeding clauses stating that the meetings shall be held "every alternate Wednesday evening" and that "no gentleman above the age of twenty-six shall be eligible for ordinary membership," the idea being then, as now, that the society should be run by and in the interest of the junior engineer—"by juniors for juniors."

The age limit has since been removed, for although it was modified to permit retention of membership by men who did not reach the twenty-six-year limit till after they had first joined, it acted injuriously by excluding many candidates of creditable status above that age, but capable of bringing a great deal of experience and enthusiasm into the conduct of the Institution's affairs, and true juniors in spirit. In all essentials the Institution retains its original juvenility and independence; there is no obstacle whatever to the use by the younger members of every one of its advantages or to attainment of its highest executive appointment, that of Chairman.

The aforesaid twelfth meeting elected a committee on development, comprising, in addition to Messrs. May and Wells, Messrs. Porter and F. R. Taylor. This committee acted with vigour, for a week later we find in the records the minutes of the first committee meeting, preceded by a list in the form following: President: Freke Field, Esq.; Chairman: Mr. S. H. Wells; Vice-Chairman: Mr. Porter; Secretary: Mr. Walter Dunn; Committee: Mr. F. R. Taylor, Mr. J. May, Mr. A. Newton, Mr. D. W. Crosland.

Mr. Wells, it will be seen, became chairman, and Mr. Walter T. Dunn secretary. The latter began on this eventful 17th December, 1884, a career of ardent usefulness in connection with the Institution and its precursor. This connection has been maintained for nearly twenty-one years to its great advantage. The appointment was at first purely honorary, and it remained so for more than five and a half years. During the last part of this period and thereafter the duties increased to such an extent that in 1893 it became necessary for Mr. Dunn to make a choice between the retention of a salaried and secure position he then occupied in the Institution of Mechanical Engineers and a precarious and less remunerative post that the Juniors at length found themselves just prosperous enough to afford him. To his lasting credit be it said that he relinquished the greater for the lesser and displayed (and not for the first or the last time) that spirit of keen regard for the Institution by which his work for it has uniformly been characterised.

The committee at its first meeting signalised their satisfaction with the progress of the society by a debauch of new rules. (Laughter.)

At the committee meeting held on December 10th, 1885, it was resolved to ask Professor A. B. W. Kennedy, at that time Professor of Engineering at University College, London, to become president of the society in succession to Mr. Freke Field. Professor Kennedy accepted office, delivered a presidential address of great interest ("Steam Engine Economy," Trans.

J.E.S., 1886) and thenceforward the society took itself very seriously.

At a committee meeting held on November 5th, 1885, the desirability of obtaining improved accommodation for the meetings had been considered and on December 18th, 1885, we find the (third) half-yearly meeting held in the Hawkstone Lower Hall, a room in the lower portion of Christ Church. This hall, a somewhat dreary apartment, was the official meeting chamber for the society for some years subsequently, notwithstanding the æsthetic shortcomings of the place, and possessed a somewhat monastic aspect and a series of seats of a truly penitential character. The members, however, were never hypercritical, and possibly found Hawkstone Hall to be an agreeable change from the holds and engine rooms of vessels in course of construction.

Following upon its change of venue to Hawkstone Hall, the society took its courage in all its hands and resolved upon the first annual dinner (held at the First Avenue Hotel on Friday, January 15th, 1886, when twenty members and four visitors attended), and by a still more important decision, requested Professor Kennedy to continue as its president, for the fourth session. The interest and influence of Professor Kennedy were of material assistance in the development of the Institution.

On March 18th, 1886, a small deputation interviewed Sir Nathaniel Barnaby, then Chief Constructor of the Navy, and invited him to become one of the society's vice-presidents. Sir Nathaniel kindly consented, and thus commenced a connection between the officers' list of the Institution and the dignified and responsible post of Chief Constructor that has remained unbroken, Sir E. J. Reed, Sir William White, and Mr. Philip Watts in turn becoming connected with it. In June, 1886, the name of the society underwent a simplification to "The Junior Engineering Society."

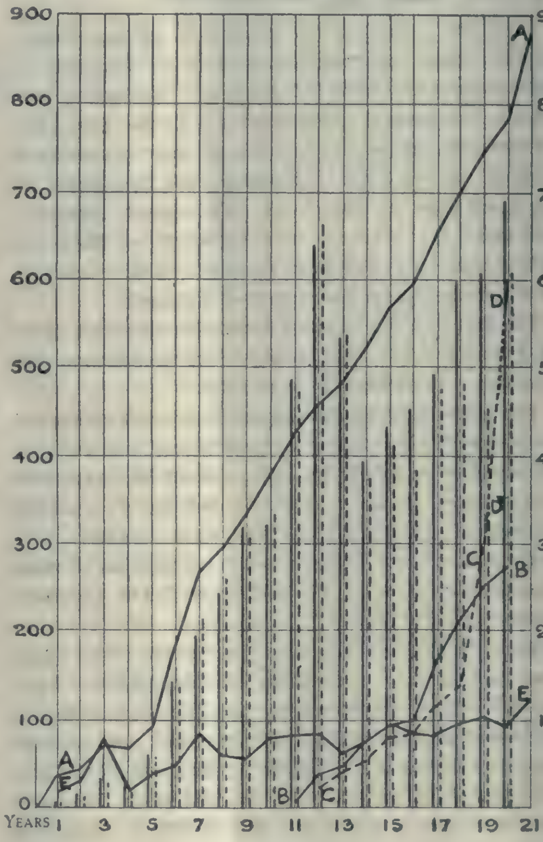
In September, 1888, the Institution altered its place of meeting to the Westminster Palace Hotel; this was a bold and pleasant change from the somewhat austere surroundings among which the papers were previously read, and it had a good effect in increasing the extent of the membership roll. At the time of this change however, as for a long time preceding it, the offices for the Institution were at the secretary's private residence. An office fund existed and slowly accumulated, but it was not until June 6th, 1901, that the council took the present offices at 39, Victoria Street, Westminster.

The Record of Transactions was first issued in the twelfth session, 1892–93, the volume then issued being Volume I. (a preface and address and papers, eight altogether, which had been read at various times in the early years of the Institution and put into print previously) and Volume II., containing the proceedings of 1891–2.

At the end of 1894 registration under the Companies Acts was mooted by Mr. Boulding, with a view of limiting the pecuniary liability of the members. Various causes led to the postponement of proceedings in this direction, but the matter has recently been taken up again, and it is probable that soon after these lines are in the hands of members the incorporation of the Institution will be an accomplished fact.

The progress of the Institution may be readily apprehended from the accompanying diagram.

PROGRESS OF THE INSTITUTION FROM FOUNDATION IN 1884.



REFERENCE.

A. A.—Membership.

Full Vertical Line—Receipts.

Dotted Vertical Line—Expenditure.

B. B.—Office Fund.

C. C.—Reserve Fund.

D. D.—Investments.

E. E.—Attendance.

From the diagram it will be seen that the membership is well on the way towards a total of one thousand.

One of the principal objects of the Institution is to afford its members opportunity for the practice of speaking in public on technical matters. In the earlier years of the Institution it was sometimes not easy for the chairman to induce debaters to rise, but in later years it has become difficult to keep the discussion within the time limit, by reason of the number of the speakers and the loquacity of some among them. The audience at a Juniors' meeting is quick to take the measure of a speaker, and very lenient and sympathetic to beginners; but it does not suffer bores gladly. And as there is the bore senile in the senior institutions, so there is the bore juvenile occasionally in the junior institution. For the confusion of the bore juvenile the Institution possesses an automatic bore-extinguisher in the form of a timepiece started by the chairman at the commencement of each speaker's remarks, and arranged to give automatically an admonitory tinkle on a small bell five minutes afterward. The device, which has seldom been known to fail, is not patented.

Throughout all the changes and developments of the institution, the fact that it is intended primarily for the benefit of junior members of the profession has never been lost sight of, and should never be obscured in the future.

The following is a summary of the membership roll, dated June, 17th, 1905: Honorary officers, 35; honorary members, 42; members, 775; associates, 22; total, 874.

A vote of thanks to the Corporation of the City of London was proposed by the Chairman of the Institution, Mr. Samuel Cutler, Junr., M.I.Mech.E., and carried by acclamation; after which the members and their friends adjourned to luncheon.

RECEPTION.

The reception on Tuesday evening at the Royal United Service Institution was largely attended. The lectures draw large audiences to the theatre, but perhaps the most interesting feature of the evening was the presentation made to the popular Secretary of the Institution, as a recognition of the excellent work he has done on its behalf. The presentation took the form of a valuable silver bowl, and it was accompanied by an address bearing the signatures of the large number of subscribers. The Nelson Centenary Exhibition was opened to the inspection of guests, and there was an excellent programme of instrumental and vocal music.

EXCURSIONS.

A very instructive programme of visits and excursions had been arranged for the week, including St. Paul's Cathedral, the Mansion House, Woolwich Arsenal, the North London Railway Works, Bow, the London County Council Tramways Generating Station at Greenwich, and New Cross Depot of the London County Council Electric Tramways, the Royal Mint, Messrs. Yarrow's Works, Poplar, H.M. Dockyard, Chatham, the Royal Doulton Potteries, Neasden Power House, and Car Sheds of the Metropolitan Railway, and the Naval Exhibition at Earl's Court. We quote the following details from the official *vade mecum*:—

MESSRS. YARROW AND CO.'S WORKS, POPLAR.

Turning to some of the general features of the works, electrical driving has been adopted. The main motive power is supplied by two compound engines, supplied by Messrs. Bellis and Morcom, of Birmingham, which drive two Parker dynamos direct, each of the latter being capable of an output of 430 amperes at 210 volts; three Lancashire boilers made by Messrs. Fraser and Son, supply steam. The engines are condensing, a large Ledward evaporative condenser, which stands in a cast-iron tank placed over the boiler-house, being supplied. It may be stated, in connection with this arrangement, that the drainage from the main roofs is collected in this tank and used for condensing purposes, so that the town water, which is otherwise used, is not required to so great an extent. The machinery for supplying power is not placed in a separate building, but is located at one end of the heavy tool bay. It is found that the Bellis self-lubricating engine works perfectly under these conditions, and as it is in the shop, it is always under supervision of a foreman.

Most of the machine tools are placed in groups, each line of shafting being driven by its own motor, the shafting is three inches in diameter, and runs at 140 revolutions per minute. Independent motors are used for driving the larger machines which are not continuously at work. Electric travelling cranes, by Messrs. Adamson, are used throughout. The air-compressing machinery is driven electrically, the pneumatic system laid down throughout the works being of a very complete nature. Arrangements are made for carrying the compressed air on board the vessels which are in course of construction on the banks of the river. This method of obtaining power has been found exceedingly convenient. Pneumatic hoists are fitted to most of the principal tools. Electric lighting is used throughout, the current being obtained from the same dynamos that supply power, although the circuits are kept separate. There is also a complete installation of hydraulic plant, which has been supplied by Messrs. Verry and Co.

(*To be continued.*)

Steel and Concrete Construction at the Antwerp Waterworks.

BY E. DEVONSHIRE, A.M.INST.C.E.

THE writer proposes to describe the construction of a covered reservoir recently completed by the Antwerp Waterworks Company at their new pumping station at Luythagen.

The materials employed in the construction of the reservoir are (*a*) rolled-steel joists, channel and angle irons forming the steel framework; (*b*) concrete surrounding this framewark; (*c*) expanded metal serving as the armouring of the concrete.

(*a*) The steel joists are of I section throughout, and are of four dimensions. The horizontal floor joists are of the Belgian standard section, 220 millimetres by 98 millimetres (corresponding to 9 in. by 4 in. English section); the joists forming the wall stanchions measure 140 millimetres by 66 millimetres (5½ in. by 2⅝ in.); the column stanchions are 120 millimetres by 58 millimetres (5 in. by 2¼ in.); and the roof joists over the end bays of the reservoir 240 millimetres by 106 millimetres (9½ in. by 4¼ in.). The channel irons forming the arched ribs of the roof are 100 millimetres wide by 40 millimetres deep (4 in. by 1½ in.), and the angle iron forming the ties at the foot of the column stanchions are of 1½ in. by 1½ in. section.

(*b*) The concrete is composed of Belgian Portland cement of the best quality, washed river sand, and pebbles screened so as to pass through a ¾-in. ring. The cement after being air slaked and tested was mixed with twice its volume of sand to form the mortar. The aggregate was gauged, and cement mortar added in sufficient quantity to fill the void with a margin of 10 per cent. Mixing was done by hand in small quantities, a minimum of water being added, and the concrete was spread in thin layers and carefully tamped.

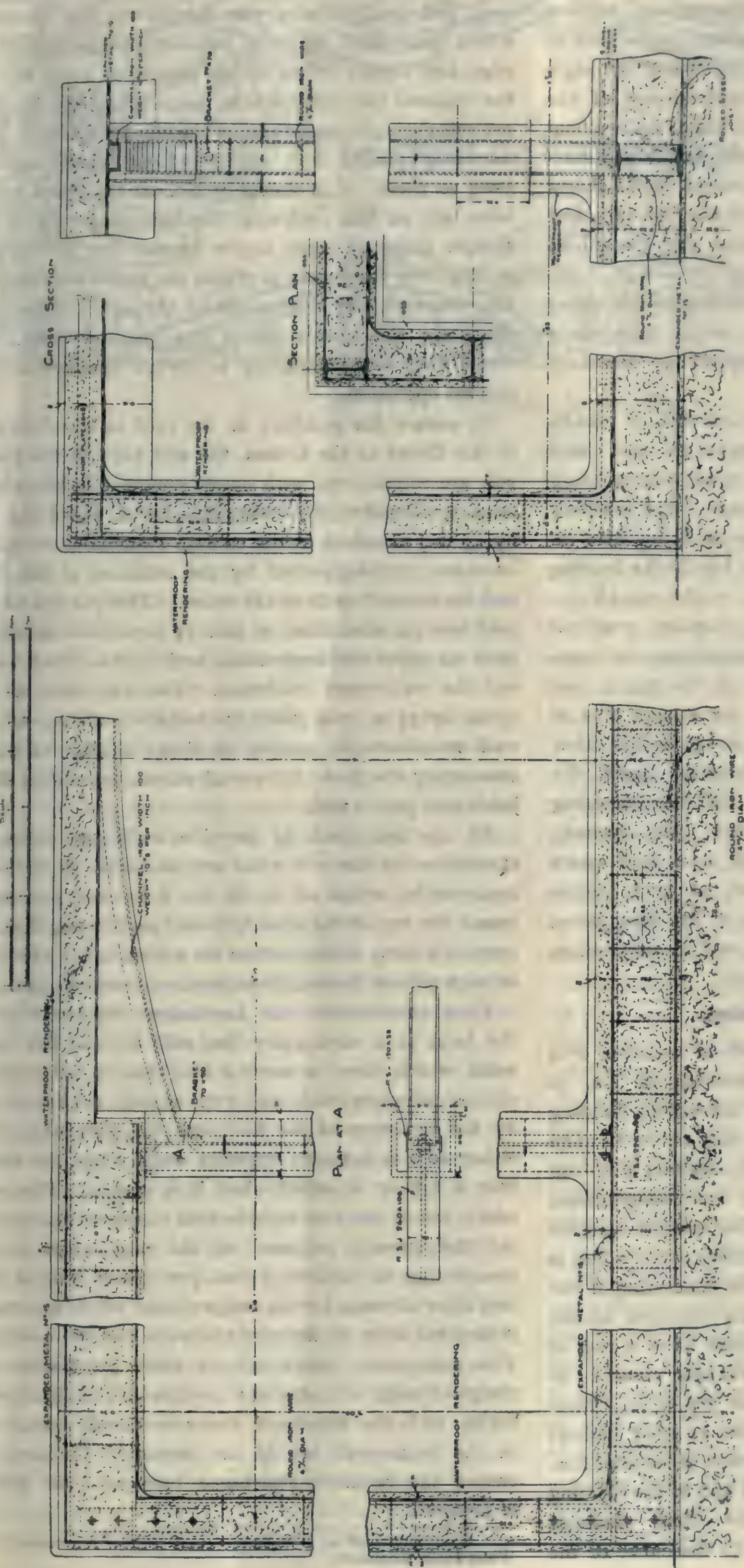
(*c*) The expanded metal was used in wide sheets of the various lengths required to span the joists of the framework with a good overlap. The principal sizes used were No. 10 (mesh 3 in., strands ¼ in. by 3/16 in.), weighing 11 lb. per square yard, and No. 15 (mesh 3 in., strands ⅛ in. by ⅛ in.), weighing 4 lb. per square yard. Expanded metal lathing was also used for covering the roof channel irons.

The reservoir measures 62·43 metres in length by 40·65 metres in breadth (253 ft. 4 in. by 133 ft. 8 in.). Its depth from floor to roof is 3·16 metres (10 ft. 6 in.), the depth of water to the top of the overflow pipes being 3 metres (10 ft.). The reservoir is built entirely underground, the outside of its flat roof being at the natural ground level.

The soil at Luythagen is a compact greenish sand, water-logged under ordinary conditions to within about 5 ft. of the surface. During the excavation of the site and the construction of the reservoir the water was kept down by pumping, the excavation being carried down to a depth of 2 ft. below the level of the finished floor.

THE USE OF EXPANDED METAL.

The foundation being prepared, and its surface floated in cement, the whole area of the reservoir was covered with No. 15 expanded metal. The meta was laid in sheets 8 ft. long by 8 ft. wide, the long diagonals of the meshes being placed at right angles to the principal axis of the reservoir. The sheets overlap each other on all four sides, the lap being 3 in. in each direction. The outside sheets are of sufficient size to extend 8 in. beyond the outside of the reservoir walls. The sheets are so placed that their lines of overlap endwise are under the floor joists carry ing the columns supporting the roof. These joists, which are of I section, 220 millimetres by 98 millimetres (approximately 9 in. by 4 in.), weighing 21 lb per foot run, are laid end to end in lengths of 10 ft. 5 in. They are united at their butting ends by fishplates bolted to them. The floor joists run from east to west in parallel lines 2·30 metres (7 ft. 6 in.) apart from centre to centre, the two outer lines of girders being, however, only 1·95 metres (6 ft. 6 in.) from the side walls. The joists being laid, wires of round iron 3/16 in. in diameter were hooked through the underlying sheets of expanded metal and turned up at each side of the joists at distances apart of 10 in. The first layer of concrete was then laid between the rows of joists, the concrete being rammed through the meshes of the expanded metal and spread in successive layers to within 3 in. of the top level of the joists. The concrete was then completed to a level of 2½ in. above the joists, a second layer of expanded metal sheets being placed in position over the joists as the concreting proceeded, and attached by the wires previouly passed round the joists. The 5 in. by 2¼ in. I joists forming the column stanchions were placed at their proper centres on the floor girders as the construction of the floor advanced. These stanchions stand vertically on the top flanges of the floor joists, the expanded



STEEL AND CONCRETE CONSTRUCTION AT THE ANTWERP WATERWORKS

metal being cut to pass round them. They are not attached to the joists, but are held in position at the foot by angle-iron ties running from side to side of the reservoir immediately over the upper layer of expanded metal, with bolts passed through them on each side of the stanchion, the angle irons being finally buried in the concrete of the floor. At the two ends of the reservoir the floor joists extend to the outside of the wall, and the wall stanchions which stand on them are here attached by plates bolted to the web of the joist, and bent to pass round the upper flange of the joist and allow of bolting to the web of the stanchion. Except where the floor joists extend at the ends of the reservoir, there are no horizontal joists under the walls. Along the end walls stanchions are placed half-way between those bolted to the floor joists, the intermediate stanchions standing on plates laid in the bottom of the floor concrete. The stanchions forming the framing of the side walls stand on similar plates at distances of 1·56 metres (5 ft. 2 in.) apart. As shown in diagram on this page, the wall stanchions are placed centrally across the walls except at the four corners of the reservoir, where they are at the outside angles.

DETAILS OF CONSTRUCTION.

The expanded metal armouring of the walls is formed of sheets of No. 15 metal placed in three rows on each side of the stanchions, the long diagonal of the meshes being horizontal. On the outside of the wall the expanded metal sheets are carried down to rest upon the sheets laid on the underside of the floor and extending beyond the foot of the wall. On the inside face of the wall the sheets are bent to a curve at the floor line, and are attached to the upper sheets of the floor so as to make a continuous armouring along the angle between walls and floor. At the four corners of the reservoir, covering sheets of metal unite the vertical armouring of the adjacent walls both inside and outside. Along the side walls the expanded metal sheets are lapped at each stanchion, to which they are attached by $\frac{3}{16}$ in. steel wires passing round the stanchions and through the meshes of the sheets.

Along the end walls, where the stanchions are closer together, the sheets of expanded metal span three stanchions, the ends being overlapped at alternate stanchions only.

For concreting the walls a rigid centreing of planks was erected outsde the expanded metal on each face of the wall, one tier of expanded metal sheets being fixed at a time to facilitate the spreading and tamping of the concrete, the centreing planks being held in position at a distance of 8 in. apart by chocks bearing against the stanchions and strutted on the outside.

The column stanchions, 323 in number, were all erected before the concreting of the columns was commenced, and were held in position at the top in one direction by the channel irons of the arched ribs of the roof, and by temporary wood struts in the other direction. Straps of wire were fastened round the column joists at intervals of 10 in., and box centreing was erected into which the concrete was rammed so as to form a square column with sides 0·18 metre (7¼ in. wide). The columns stand at 3·12 metres (10 ft. 5 in.) centres along the axis of the floor joists, and the Golding arches above them, and at 2·30 metres (7 ft. 6 in.) centres across the reservoir.

THE GOLDING ARCHES.

The roof is a continuous flat slab of concrete 0·14 metre (5½ in.) thick, with an armouring of No. 10 expanded metal at its lower face carried on Golding arches spanning the columns from east to west. The Golding arch, which is formed of a channel iron 100 millimetres (4 in.) wide, weighing 10·8 kilogrammes per metre run (7¼ lb. per foot run) filled in with concrete to the level of the slab roof, constitutes a rib which is an integral part of the flat roof, the concreting of the covering slabs and of the ribs being executed at the same time. The channel irons, which have a rise of 11 in., spring from angle-iron brackets riveted to the I joists within the columns, the top of the joists and the flanges of the channel irons at their highest point being at the level of the underside of the roof concrete. The centreing of the flat roof and of the Golding arches form one structure. The steel channels were first wrapped in lathing bent to the curve of the arch and hooked over the flanges of the channels, which were then enclosed between planks placed on edge and supported on struts placed on each side of the columns (see illustrations, page 1383), the flat roof centreing being formed of planks placed parallel to the arch centreing planks and supported on cross battens fixed to them. The sheets of No. 10 expanded metal were laid on this centreing, the long diagonals of the meshes being at right angles to the line of Golding arches, over the centre of which the sheets were lapped. The concrete was then rammed through the meshes, filling up the spaces above the channel irons, the whole floor being made up to its full height in a continuous operation.

To ensure the stability of the roof in the direction of the thrust of the arches, the end bays of the reservoir are roofed over with heavy concrete work carried on 240-millimetre by 106-millimetre I joists (9½ in. by 4¼ in.) attached to the column stanchions by angle brackets, and supported by the columns at one end and by the end walls at the other. This portion of the roof has an armouring of No. 15 expanded metal on both its upper and lower faces, and is 12 in. thick without the waterproof rendering. The wall ends of the 9½ in. by 4¼ in. roof joists are bolted to the top of the wall stanchions by means of plates similar to those connecting the foot of the wall stanchions to the floor joists (see page 1395).

All the stanchions of the side walls and alternate stanchions of the end walls are anchored to the roof concrete by strips of 1½ in. by ⅜ in. bar iron bent round the top of the stanchion and penetrating the concrete in a horizontal direction for a distance of 2 ft. 6 in. on each side of the stanchion (see cross-section page 1395.

Thus constructed, the Luythagen Reservoir is in the form of a rectangular box with a fixed lid. The walls, which have to carry a load due to the pressure of 10 ft. of water inside and 5 ft. outside, are supported by the structure of the floor and the roof, which act either as ties between opposite walls when the reservoir is full or as struts when it is empty. The roof which has to carry an outside load sufficient to counteract the upward pressure on the floor when empty (amounting to possibly 3 cwt. per square foot of surface after allowing for the weight of the whole structure) is strutted from the floor by the walls and the columns. The component parts of the steel framework are designed each to carry its portion of the distributed loads, and the armoured concrete panels which fill in the framework are of the necessary thickness to ensure the requisite resistance between their points of support.

Read this week at a meeting of the British Association of Waterworks Engineers.

The Bout de l'Isle Bridge.

By J. L. Morris, M.Can.Soc.C.E.

The Bout de l'Isle Bridge, though not forming one of the list of the International and Interprovincial bridges, as yet few in number, has claims to be classed with the prominent bridges of Canada. It is composed of two crossings over the east and west branches of the Ottawa River, formed by Ile Bourdon, just above the junction with the St. Lawrence River at the foot of the Island of Montreal.

The location is practically the same as determined by the engineers of the Quebec, Montreal, Ottawa and Occidental Railway, as an alternative crossing of the Ottawa River for an entrance into Montreal for the through line from Quebec in 1874. This bridge now forms the crossing of the Ottawa River, for the Chateauguay and Northern Railway Company, on their line from the City of Montreal, to the town of Joliette on the line of the Great Northern Railway, which now forms that part of the trans-continental line of the Mackenzie and Mann system which connects Quebec and Hawkesbury.

The west channel, that between the island of Montreal and Ile Bourdon is about 1,500 ft. in width, and the bridge crossing it comprises the following spans: a deck plate girder 46 ft. in length between the west abutment and pier number 1; four through trusses each 140 ft. in length from pier number 1 to pier number 5; a through truss 200 ft. in length from pier number 5 to pier number 6; four through trusses each 140 ft. in length from pier number 6 to pier number 10; and a deck plate girder 46 ft. in length between pier number 10 and the east abutment. The distance across Ile Bourdon, between the abutments of the west and east channels is about 2,100 ft.

The east channel, that between Ile Bourdon and Charlemagne, is about 1,300 ft. in width, and is crossed by the following spans: a deck plate girder 70 ft. in length between the west abutment and pier number 1. Seven through truss bridges each 140 ft. in length from pier number 1 to pier number 8; a deck plate girder 70 ft. in length between pier number 8 and the east abutment.

The 2,100 ft. stretch across Ile Bourdon, is composed of earth embankment, while at the other end of both crossings, the approaches are built of temporary trestles, each about 2,000 ft. in length.

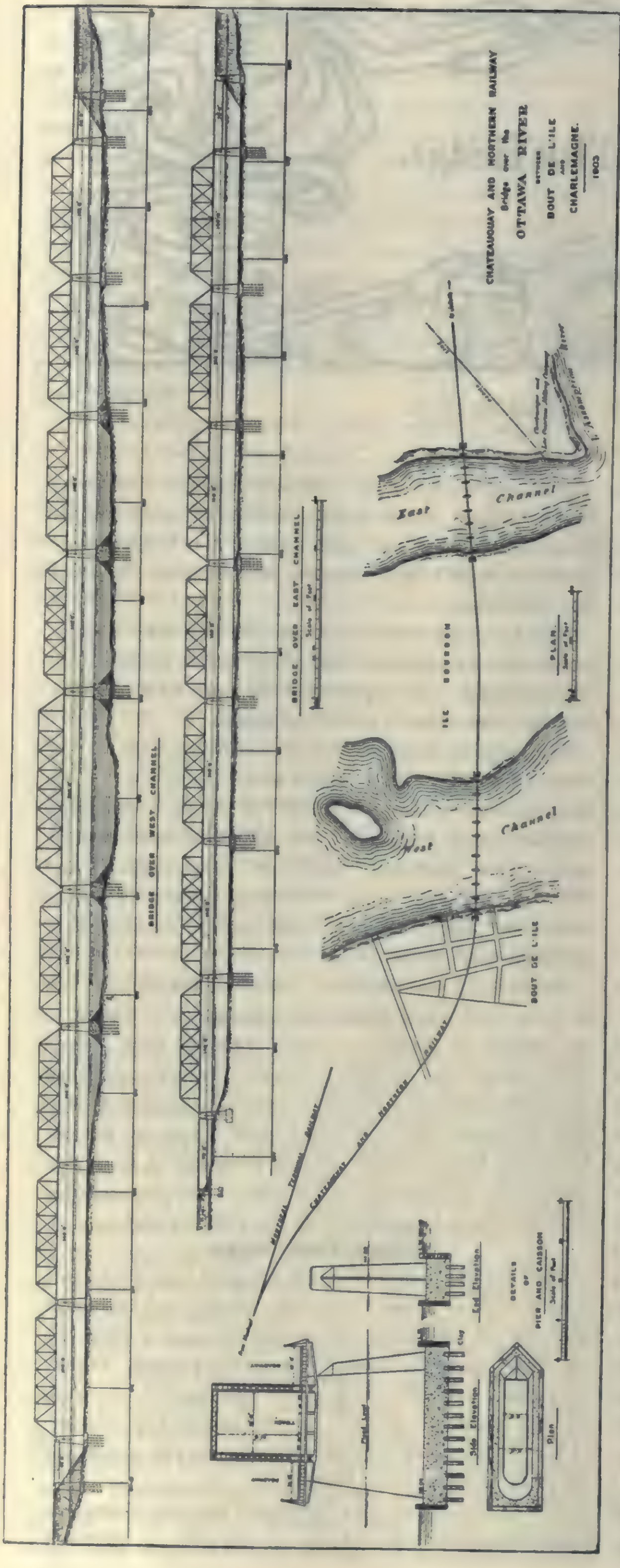
The original contract for the sub-structure of the bridge was let to F. C. Dunn and Co., of New York, in 1902, who sub-let to the W. J. Poupore Company of Montreal, in February, 1903, all of the work coming under their contract with the Chateauguay and Northern Railway Company, being twenty-five miles of railway line, which included the sub-structure of the Bout de l'Isle bridge.

Preliminary construction, such as the cutting off of piles and the building of caissons, was begun in the month of February, and continued until March 18th, when the breaking up of the ice compelled the contractor to stop work until the spring freshet had subsided, and the water had fallen in the St. Lawrence River. Much of this preliminary work was injured by the action of the ice, which was carried past the site in large blocks by the swift current.

FOUNDATION WORK.

Piles for the foundations of all piers and abutments were driven at about three feet centres, and this work was carried on during the winter of 1902–3 from the ice, which notwithstanding the strong current, formed to a good thickness, and made this part of the work an easy matter, especially as the material in the bed of the river caused no inconvenience in the driving of the piles, being of a stiff blue clay.

The Chateauguay and Northern Railway Company being responsible for cutting off the piles, as required



for the foundations of the piers and abutments, made an effort to cut the piles of pier number 4 by using one diver from an anchored scow. Owing to the swiftness of the current this was found to be impracticable, and the balance of this part of the work was carried out by the W. J. Poupore Company, who to ensure the safety of the men employed below water, took all the precautions which were possible. A large scow was securely snubbed to the head of the piles, which came near to the surface of the water. Just above the piles upstream from the pier a temporary crib, triangular in shape was sunk with the nosing up stream, which broke the current and caused practically still water around the piles. Even with this advantage it was considered inadvisable to use one diver in cutting the piles, and two were used in preference. As many as twenty-four piles per day were cut off about 18 in. above the level of the bed of the river

The foundations of the east and west abutments, and piers 1, 2, 3, 9, and 10 of the west channel, were constructed, together with all the foundations of the east channel, by building cofferdams. Piers 4, 5, 6, 7, and 8 of the west channel had their foundations constructed by the use of caissons. These caissons were constructed 18 in. larger on all sides than the required dimensions of the concrete foundation of the pier, with 12 in. by 12 in. squared timber, well braced on the inside, then all joints well caulked so as to make it watertight. The timbers were scribed to fit the bottom of the stream at the site where the caisson was to be sunk.

PLACING THE CAISSONS.

At the placing of the caisson for pier 4, it was thought possible to anchor it in place by the use of three ship anchors, attached with cables to the nosing and corners of the caisson, but owing to the swiftness of the current and the slippery condition of the clay in the bottom of the stream it was found impossible to do so, and no effort was made afterwards to place any of the piers with them. It was at this pier number 4, that owing to the anchors slipping, the caisson capsized and threw the men into the water. All the five caissons were finally placed by means of two cables attached to trees on an island about 2,500 ft. above the bridge site, and as a protection to the public were floated on cedar poles with spaces of about 30 ft. between them, and were attached one on each side of the caisson, and with a third cable against the current from the nearest pier on the work, we were able without mishap to place all of the caissons.

At the shore ends where the water was shallow and where cofferdams were used the concrete was brought to its finished level without delay, as there was no difficulty in keeping out the water from the cofferdams, but in those foundations where caissons were used, the concrete was filled under water to within five or six feet of the required level, and after five or six days the water was pumped out and the balance of the concrete brought to a finished level.

After the placing of the caisson and before any concrete was filled in, the diver made a careful examination of the bed of the river within it, and of its bearing on the bottom. The only difficulty was with pier 5, which did not fit the irregular bottom, and it was necessary to line the inside of the pier with heavy canvas, and place concrete in bags around the inside edge of the caisson to stop the flow of the water through the concrete, and prevent the carrying away of the cement and sand.

The concrete used in the foundations was composed of 1 part of cement, 2 parts of sand, and 5 parts of broken stone. The brands of cement principally used were Invisible (a Canadian cement), Dyckerhoff and Haemoor (both German cements). The supply of crushed stone was brought from the quarries of the W. J. Poupore Company, at the east end of Montreal, and delivered to the work on large scows.

CONSTRUCTION OF PIERS.

The level of the finished concrete in the foundations was one foot below the low water level for piers 2, 3, 4, 5, 6, 7, 8, and 9 of the west channel, and for all piers in the east channel. The abutments of both crossings were 44 ft. in width, 22 ft. 6 in. from the top of the concrete to the bridge seat, and 5 ft. from the brdge seat to the top of ballast wall. The thickness of the abutment at the bridge seat was 6 ft., the front wall having a batter of 1 in 24. Piers 1 and 10 in the west channel were 27 ft. and 6 in. in height above the concrete, with a width of 6 ft. at the top, and a batter of 1 in 24 on all sides, the bridge seats for the longer spans being lower than for the shorter spans bearing on these piers. The upstream end of all piers have cut-waters commencing at the level of the concrete foundation and reaching to within about 4 ft. of the level of the bridge seat. The lower or down stream ends of the piers are circular, and so carried up to the bridge seat level.

Piers 2, 3, 4, 5, 6, 7, 8, and 9 of the west channel are similarly constructed, all being 30 ft. in height, above the concrete foundation to the bridge seat level, 6 ft. in thickness at the bridge seat, and with a batter of 1 in 24. The piers 1 to 8 inclusive of the east channel crossing are all 25 ft. in height above the concrete level to the bridge seat, 5 ft, in width at the bridge seat, and with a batter of 1 in 24. These piers were otherwise built similarly to those of the west channel.

All stone supplied for the masonry of this bridge came from the Terrebonne quarries in courses ranging from 18 in. to 30 in. in thickness, and is a good quality of lime-stone for pier construction. The mortar used in the work was composed of one part of cement and two parts of sand. Much expense was incurred in the handling of the stone, which was first unloaded from the cars at the west end of the west crossing, and distributed from this point by lorry cars to temporary wharves, and then loaded on scows and towed to the pier where required. This necessitated, especially during the low water season, temporary wharves at both shores of the two crossings, and as the water receded, these had to be further carried out so as to give sufficient water to float scows and tugs.

At the latter part of the season the water in the east channel became very shallow, and the larger scows could not be brought to the site of the bridge when loaded with building material. A landing place was made about 1,000 ft. below the crossing and the material transferred to smaller scows, and towed to the work with tugs of very light draught. This necessarily caused considerable delay in carrying on the work The engineers of the Chateauguay and Northern Railway laid out all work without using triangulation for the placing of caissons and the centring of piers. This was made practicable, by having good ice to work upon during the winter, and making use of the piling of the foundations of the piers, which in all cases came near to the surface of the water, and allowed of the engineers making steel tape measurements from pier to pier. The measurements given by the engineers worked out satisfactorily, both as to centre and span.

The first masonry of the west channel was laid on April 1st, 1903, and on September 10th of the same year the substructure was complete, comprising two abutments and ten piers, which contained 2,138 cubic yards of concrete foundations, and 2,983 cubic yards of masonry. The steel work was completed over this channel about October 1st.

The masonry of the east channel was commenced on August 10th, 1903, and completed on November 15th, 1903, comprising two abutments and eight piers, which contain 600 cubic yards of concrete in foundations, and 2,060 cubic yards of masonry.

On the twenty-five miles of railway construction between Bout de l'Isle and Joliette four smaller bridges and seven arch culverts were built at the same time as the Bout de l'Isle, and contained 3,500 cubic yards of concrete.

Read before the Canadian Society of Civil Engineers.

NAVAL NOTES.

THE FRENCH CRUISER "D'ASSAS."

On trial this vessel did 7,960 I.H.P. = 18 75 knots. Her displacement is 3,990 tons. Owing to instability she has had her double bottom filled with sand.

HIS Majesty King Edward has been appointed by King Oscar of Sweden a flag admiral of the Swedish navy.

Concerning the French naval visit, we note that the men are to be invited to an entertainment in the Guildhall on August 11th, the day following the déjeuner to the officers.

Whale Island is not to have its own power station, but is to be supplied with current from the new generating station to be erected in Portsmouth Dockyard.

The court-martial for the investigation of the circumstances under which Submarine A8 was lost at Plymouth concluded on the 21st inst. at Devonport. The Court found that the submarine foundered through alterations in buoyancy and trim from some unexplained cause. It regretted that the commanding officer did not stop the engine sooner, but acquitted the survivors of all blame, and returned their swords to the two officers.

At the inquest on the bodies of the fifteen men who lost their lives by the disaster, the jury found that one of the men was drowned in the conning-tower and that the others lost their lives from asphyxiation from some poisonous gas emitted after the submarine foundered.

The fourth armoured cruiser of the French 1900 programme will be launched in August, She will be known as the *Jules Michelet*, her predecessors being the *Leon Gambetta*, *Jules Ferry* and *Victor Hugo* The fifth and last cruiser of the series, the *Ernest Renan*. is in course of construction at Saint Nazaire.

Since our last notes, another first-class battleship of the *King Edward VII.* class has been put into the water. The *Hibernia*, launched at Devonport Dockyard, was designed by Sir William H. White, her principal dimensions being: Length between perpendiculars, 425 ft.; extreme breadth, 78 ft.; draught of water forward, 26 ft. 3 in.; aft, 27 ft. 3 in.; and load displacement, 16,350 tons. The engines, by Messrs. Harland and Wolff, Belfast, will consist of two independent sets of the vertical triple-expansion type, each having four cylinders. Each set will be capable of developing 9,000 indicated horse-power, with 120 revolutions per minute. The speed contracted for at full power is 18½ knots. There will be eighteen separate water-tube boilers of the Babcock and Wilcox type, and three separate cylindrical boilers. The armament consists of four 12-in. breech-loading guns, worked in two barbettes, four 9·2-in. breech-loading guns in four barbettes, ten 6 in. breech-loading guns worked in a battery, twelve 12-pounder 18-cwt. quick-firing guns, two 12-pounder 8-cwt. quick-firing guns, fourteen 3-pounder quick-firing guns, two ·303 Maxim guns, and four submerged torpedo tubes. The total complement of officers and men will be 781.

Sir Andrew Noble, in stating these facts at the launch, mentioned that the *Achilles* is the twenty-first war vessel constructed at Elswick for the British navy. The first built there from the designs of Mr. Philip Watts since he left Elswick to undertake the post of Director of Naval Construction at the Admiralty. The last vessel bearing the name of *Achilles* in the British navy was built at Chatham, in 1864. She was constructed of iron, and was propelled by a single screw. Her length was 380 ft.; breadth, 58 ft. 3½ in.; she had a displacement of 9,820 tons. The indicated horse-power of her machinery was 4,000, which gave her a speed of 12¾ knots. Her main armament consisted of 14·9 in. guns of the old muzzle-loading type; her side and bulkhead armour was 4½ in. in thickness; she carried 750 tons of coal. She was classed non-effective in 1901. Thus it would be seen in comparing the new with the old *Achilles* that the vessel launched that day, although only about 4,000 tons, or roughly speaking, 33 per cent. heavier than her predecessor, carried 1,250 tons more coal, the indicated horse-power of her machinery was nearly 20,000 more, whilst she would be able to travel twice as fast as the old vessel. These figures were interesting as illustrating recent development in naval construction, marine engineering, and ordnance manufacture.

Referring to the war in the Far East, he said the Japanese had taught lessons to Europe. They had not disclosed where they were about to strike, and at the same time the highest traditions of warfare had been maintained. All their victories had been stated with modesty and without exaggeration. Whilst everyone knew, Sir Andrew added, that many of the ships in Admiral Togo's fleet were built at Elswick it was not so well known that every vessel of his fleet was armed from Elswick. That must be a satisfaction not only to Elswick, but to all Tyneside.

The first-class armoured cruiser *Achilles*, launched at Newcastle, is one of the four vessels of this class provided for in the Naval Estimates of 1903–4, the others being the *Warrior*, the *Natal*, and the *Cochrane*. Her length overall is 505 ft. 3-in.; length between perpendiculars, 480 ft.; breadth, 73 ft. 6 in.; displacement, 13,660 tons. The designed indicated horse-power of the machinery, by which she will be propelled is 23,500. She will have twin screws, driven by independent vertical triple-expansion engines. Steam for driving these will be generated in twenty-five boilers, nineteen of which will be of the Yarrow water-tube type, and six of the single-ended cylindrical type. Her estimated speed will approach 23 knots. The coal-carrying capacity of the vessel is 2,000 tons. The armament to be installed in the *Achilles* is a powerful one, consisting of six 9·2 in. guns, four 7·5 in. guns, two 12-pounder guns twenty-four 3-pounder guns, and two Maxim guns, in addition to three 18-in. torpedoes. The armour on the sides of the vessel is 6 in. thick and the armour bulkheads and barbettes being of the same thickness. The armour of which the conning tower was constructed has a thickness of 10 in. Accommodation will be provided in the vessel for a complement of 704 officers and men.

By way of a set-off to the absurd scares which have been industriously circulated on the subject of Britsh naval guns the following remarks are quoted from Lord Selborne's speech at the recent Pretoria Banquet. Mr. E. Chappell, in proposing the Army, Navy and Volunteer Forces, had alluded to the fact that the British Navy is a volunteer service. "It is," said Lord Selborne, "and so I pray from the bottom of my heart it will always remain. Fifteen years ago there were 60,000 seamen of all ratings in the Navy. To-day there are 130,000. That increase has been achieved without the slightest difficulty. The whole of the four-and-a-half years I was at the Admiralty I had not to go in search of men to serve in the fleet. I had to keep raising the standard of education, character, and physique in order to keep the men out. The Navy contains the cream of our population in all its ranks. The sailor has one wonderful advantage. All through his professional life, from a child to an old man, he has the privilege of fighting against nature, and nothing that a man can do in the stress of war is comparable to what he has done while fighting against nature in his professional career. Never, I believe, even in the golden days of Drake and Nelson, has the Navy stood higher than it does to-day, and in this land, so famous for marksmen, it will be appreciated when I tell you that it is now a common record for His Majesty's ships at 7,000 and 8,000 yards, with the biggest guns, to make 33 per cent. of hits on a target 80 ft. by 20 ft."

Openings for Trade Abroad.

Portuguese East Africa.

A decree has been published authorising the expenditure of about £300,000 on the construction of a railway from the port of Mossamedes to the plateau of Chella, in the Province of Angola.

Mexico.

The representative of Senor G. A. Lilliendahl, has been authorised to appropriate, for the production of motive power, 8,000 litres per second from the river Pilón, Municipality of Rayón, State of Nuevo Léon Machinery, etc., required for these works may be imported free of duty.

Belgium.

Tenders, which will be opened on July 27th at the "Direction du service spécial de la côte," Ostend, are invited for the construction of a quay wall on the eastern side of the dry dock, and of a water wing in the wet dock at the port of Blankerberghe, at the upset price of £25,895. Tenders will be received until July 23rd.

Italy.

According to a recent consular report, the principal railway lines projected in Sicily are the following: (1) Castelvetrano-Menfi-Sciacca, connecting with the Trapani system; (2) Sciacca-Porto Empedocle, joining the Sicula trunk line; (3) Assoro-Piazza Armerina, connecting with Sicula; (4) Paterno-Nicosia, connection with the Etna Railway; (5) San Carlo-Sciacca, connecting with Corleone Railway. For the San Carlo-Sciacca narrow-gauge line the Government offers a concession of 70 years with a kilometric subsidy of 8,500 fr. For the Paterno-Nicosia line the subsidy per kilometre has been raised to 7,500 fr. All further particulars regarding the conditions of the contracts can be obtained on direct application to the Minister of Public Works at Rome.

Spain.

The Port Works Board at Alicante invite tenders for the supply of two electric cranes, with a capacity of 10,000 and 1,500 kilos. respectively, fitted with revolving cages, in accordance with conditions on view at the above-mentioned offices, at the upset price of £3,222. A deposit of £45 is required to qualify any tender, which must be delivered before September 14th.

Natal.

A Board of Trade correspondent notifies that the Natal Government intend to complete with all despatch a wharf 2,000 ft. in length along part of the lands known as Congella Lands. The reclamation of these lands is now being carried out.

The Future Field for Gas Producers.

ACCORDING to Mr. Samuel S. Wyer, in a paper read before the American Institute of Mining Engineers, the fact that gas-producer power-plants have received so little attention in America may be attributed to five conditions: (1) ignorance and prejudice; (2) newness of work; (3) inadaptability of gas-engines; (4) fuel economy not imperative; (5) smoke nuisance not given attention. Nevertheless, the author said the time was not far distant when gas-producer locomotives for railroad service, gas-producer portable engines, and gas-producer power-plants for marine service would be in common use.

Gas-Producer Locomotives.

These gas-producer locomotives would be smokeless. Trains and stations might be kept cleaner. Tunnels could be passed through with greater safety, and comfort of passengers would be increased. Being cinderless fuel loss would be decreased, large fire losses due to sparks would be eliminated entirely, and insurance rates on property adjacent to railroads would be less.

As regards economy, the amount of fuel used would be less than one-half that used on steam-locomotives, and the amount of water less than one-eighth. The time required to take fuel and water would be less. There would be economy of labour in firing on account of automatic feed and decreased amount of fuel used, In idleness stand-by losses were very low; and there would be economy in the number of fuel and water-stations required. The apparatus would be safer, since the danger of boiler explosions was eliminated.

Gas-Producer Portable Engines.

In this direction the advantages were set forth as follows: Owing to the smokeless qualities of the apparatus large fire losses due to sparks would be eliminated entirely; insurance rates on property adjacent to where an engine was used would be less. It was more economical in water, fuel, labour, and time required to secure fuel and water, and also safer, the danger of explosion being eliminated.

Gas-Producer-Power-Plants for Marine Service.

Here, owing to the plant being smokeless, ships might be kept cleaner; passengers would have more comfort; a battleship could conceal its location more easily. The apparatus would be more economical in fuel, water, time for taking to fuel, bunker capacity, floor space, and in apparatus required, since all of the condensing machinery would be dispensed with.

OUR WEEKLY BIOGRAPHY.

Mr. HENRY EVANS,

Goods Manager, Midland Railway.

MR. HENRY EVANS, who recently took over the general management of the goods department of the Midland Railway, was born at Alfreton in 1857. He began his railway career at the age of sixteen as a junior clerk at Chesterfield. His advancement was rapid, for in six years he graduated to the position of chief clerk. In 1879 he was transferred to Derby, where he held various responsible posts in the goods manager's office until 1884, when he accepted an appointment under the late Mr. G. H. Turner, who was the goods manager of the Glasgow and South-Western Railway. Four years later he was made carting superintendent; in 1889 he became College Station superintendent, and was subsequently made head of the goods department, which position he occupied until he received his present appointment.

THE BULLARD 36-in. VERTICAL TURRET LATHE.

A THIRTY-SIX-INCH boring mill of special design, having a vertical side rail as well as a horizontal cross rail for the support of tool heads, is shown in the accompanying illustrations. It is a new product of the Bullard Machine Tool Company, Bridgeport, Conn., U.S.A., and has been given the distinguishing name of a "Rapid Production Vertical Turret Lathe."

The analogy between this machine and a lathe is brought out in figs. shown on page 1386, which gives a top view that in many respects resembles a horizontal turret lathe. The side head gives to the tool a lathe characteristic which hitherto has not been found in a boring mill, and increases its capabilities. Fig. 1 shows a front view of the machine, and fig. 2 rear view, in which the driving and feeding arrangements may be seen.

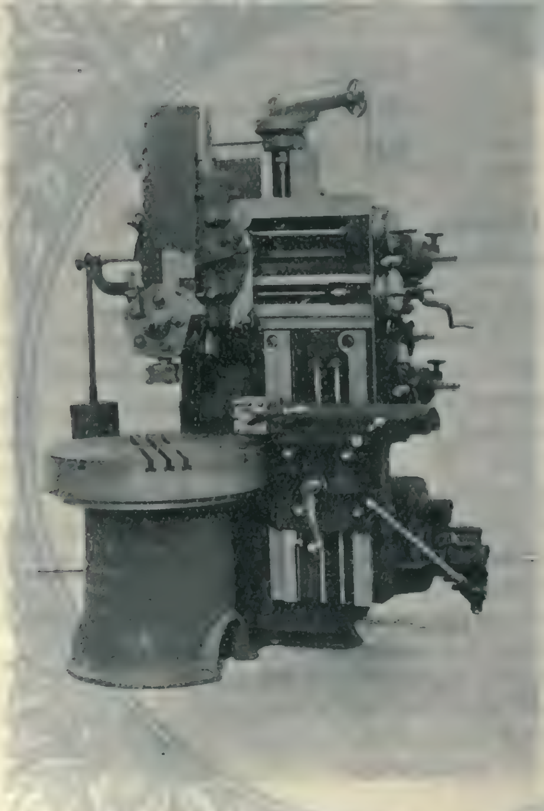


FIG. 1. FRONT VIEW OF MACHINE.

The two heads are entirely independent in their feed movements, and both heads have vertical and cross feeds. The heads are also independently counterbalanced. One of the most important features of the machine is the possibility of using both of the heads simultaneously without their interfering on work of small diameters. Another advantage is that no long boring bars or extended tool holders need ever be used in the vertical turret, the side head turret being available for operations which would ordinarily require such an equipment. The side head carries a four-face turret. A thread-cutting attachment may be applied to vertical head, if desired, without special fitting.

The machine is driven from a constant speed pulley, and has fifteen speed changes, obtained through a cone of gears and a driving key in a gear box at the rear of the machine, on the opposite side from the driving pulley. It is manipulated by a lever at the front within easy reach of the operator, as are also the other controlling levers of the tool, a fact which is well brought out in fig. 1. The table is 34 in. in diameter, and is driven by an internal spur-gear of a diameter nearly that of the table. The table speeds range in geometrical progression, the maximum surface speed being 21 ft. per minute at 2 in. diameter and the minimum speed 27 ft. per minute at 36 in. diameter. The driving pulley may be run continuously, as it is possible to stop the table at any intermediate point between each speed, when the direct-acting brake may be applied by lifting the speed lever.

The feed changes are also obtained from gear boxes in a similar manner to the table speed changes. Changes are made by small hand wheels, which may be seen in fig. 2, the feed per revolution being indicated on a direct reading index plate on the feed box. Each head has its own feed box, and in each eight changes are obtained for each, the horizontal or vertical direction. The range of feeds is from $\frac{1}{90}$ to $\frac{1}{2}$ in. per revolution. Pull gears of feed rods have been eliminated, worm gears keyed to the rods being used instead. The horizontal or vertical trains of feeding mechanism for the head on the cross rail are thrown in and out by a drop worm, which may be caused to engage with one or the other of the worm wheels on the horizontal and vertical movements respectively, or midway between released from both. The worm is manipulated by a lever extending to the front of the feeding mechanism. When the worm for feeding the side head is engaged with the worm wheel on the feed shaft, the latter may be engaged through spiral gears and a clutch with either the screw for vertical travel of the carriage or a splined vertical shaft for the horizontal travel. With the worm in its dropped position the feeds are thrown out. Each speed has a micrometer index. Safety points are provided for in the feeds so that carelessly permitting the heads to run together results in no damage or delay. This device in no way weakens the feeds, and is not in use when the threading attachment is engaged.

The vertical head mechanism is the same as in the recent boring and turning mills of the Bullard make. It is operated in all directions by power. It carries a six-faced turret, will face a diameter of 36 in., and has a vertical and angular movement of 26 in. The cross and side rails are connected together, forming a unit, which has a vertical movement by power of 12 in. The saddles have a narrow guide bearing of the same type as Bullard mills, the ratio of length to width being great, preventing tilting and binding of the heads.

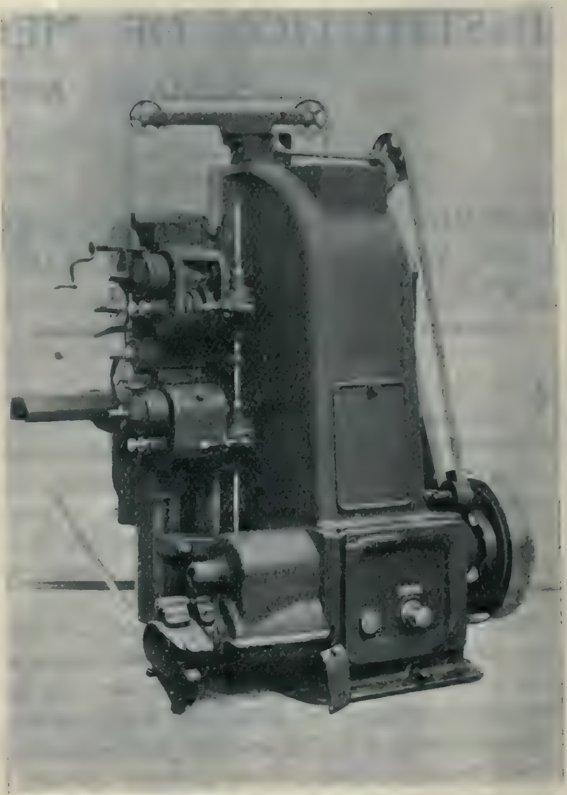


FIG. 2. REAR VIEW.

The lubricating system is thorough, all high-speed shafts being bronze bushed and self-oiling. The trains of gears in the drive and feed boxes are immersed in oil, as is also the table spindle, sight cups being placed so that the oil level may be constantly maintained. The weight of this machine is 9,800 lb., and the floor space occupied 65 in. by 70 in. The illustrations show the belt-driven form, but it may be equipped with a $7\frac{1}{2}$-h.p. motor, mounted on a bracket at the rear, the speed of the motor not to exceed 1,200 revolutions per minute.

This machine is also furnished without the side head by the manufacturers, in which form it has a capacity of 41 in. in diameter.

INSTITUTION OF MECHANICAL ENGINEERS.

SUMMER MEETING AT LIÉGE.

(*Continued from page* 1365.)

SUPERHEATERS IN LOCOMOTIVES ON THE BELGIAN STATE RAILWAY.

COCKERILL SUPERHEATER FOR COMPOUND LOCOMOTIVES.

IT is clear from the preceding that it is now known that superheated steam, as applied to locomotives, is susceptible of giving remarkable results which come within the domain of practice. The State Railway has decided to persevere with its experiments in combining superheat with compounding, because it is perceived that there is a most interesting question to elucidate.

Is it more economical to divide the superheater into two parts in such a manner as to raise the temperature at the entrance to both the high-pressure and the low-pressure cylinders, or, on the other hand, to devote the whole power of the apparatus to superheating the steam before it enters the low-pressure cylinders? The Cockerill Company, after numerous investigations, have just completed a superheater that will enable them to settle this question. This entirely new system is being continually tested on a series of compound engines, with four cylinders, and six-coupled wheels of 1·80 metres diameter (5 ft. 10 in. diameter) with a bogie.

The apparatus for superheating the steam may be used in two ways. One may heat the steam near to the entrance to the high-pressure cylinder, and afterwards near to those of the low-pressure cylinders, or at the entrance of the low-pressure only. The general arrangement comprises two series of large flame tubes containing the circulating pipes intended to superheat the steam.

A locomotive of a type showing this pattern of superheater, is exhibited in the Liége Exhibition. Trials are going to be continued with a second identically similar engine, to determine which is the more advantageous mode of working to adopt for the new superheater.

It is manifest that if the superheat is required at the entrance of the low-pressure cylinders only, it will be possible to dispense with a certain number of parts of the superheater, and by that means remedy the obstruction in the smoke box.

THE EFFECTS OF STEAM-JACKETING.

Mr. A. L. Mellanby read a paper with the title: "An Investigation to Determine the Effects of Steam-Jacketing upon the Efficiency of a Horizontal Compound Steam Engine," of which the following is an abstract:—

At the present time there is much diversity of opinion as to whether steam-jacketing the cylinders of reciprocating steam-engines has any considerable influence upon their economy. Much information has been collected by the committees appointed by this Institution to inquire into the subject, and the results of many trials have been collected and tabulated by them. As the outcome of these and other investigations, opinion has become somewhat settled on the following lines: That jackets are useful for slow revolution, but not for quick-revolution engines; that jackets are useful for simple and compound engines, but that their efficiency is doubtful, if they are applied to triple or quadruple expansion engines.

It has long been obvious that there was considerable room for further experimental research upon this subject, and the author has carried out certain tests.

After devoting considerable thought to the matter the writer determined upon the following scheme of experiments: to run a series of trials at the same boiler pressure, revolutions and vacuum, with different points of cut-off in the high-pressure cylinder.

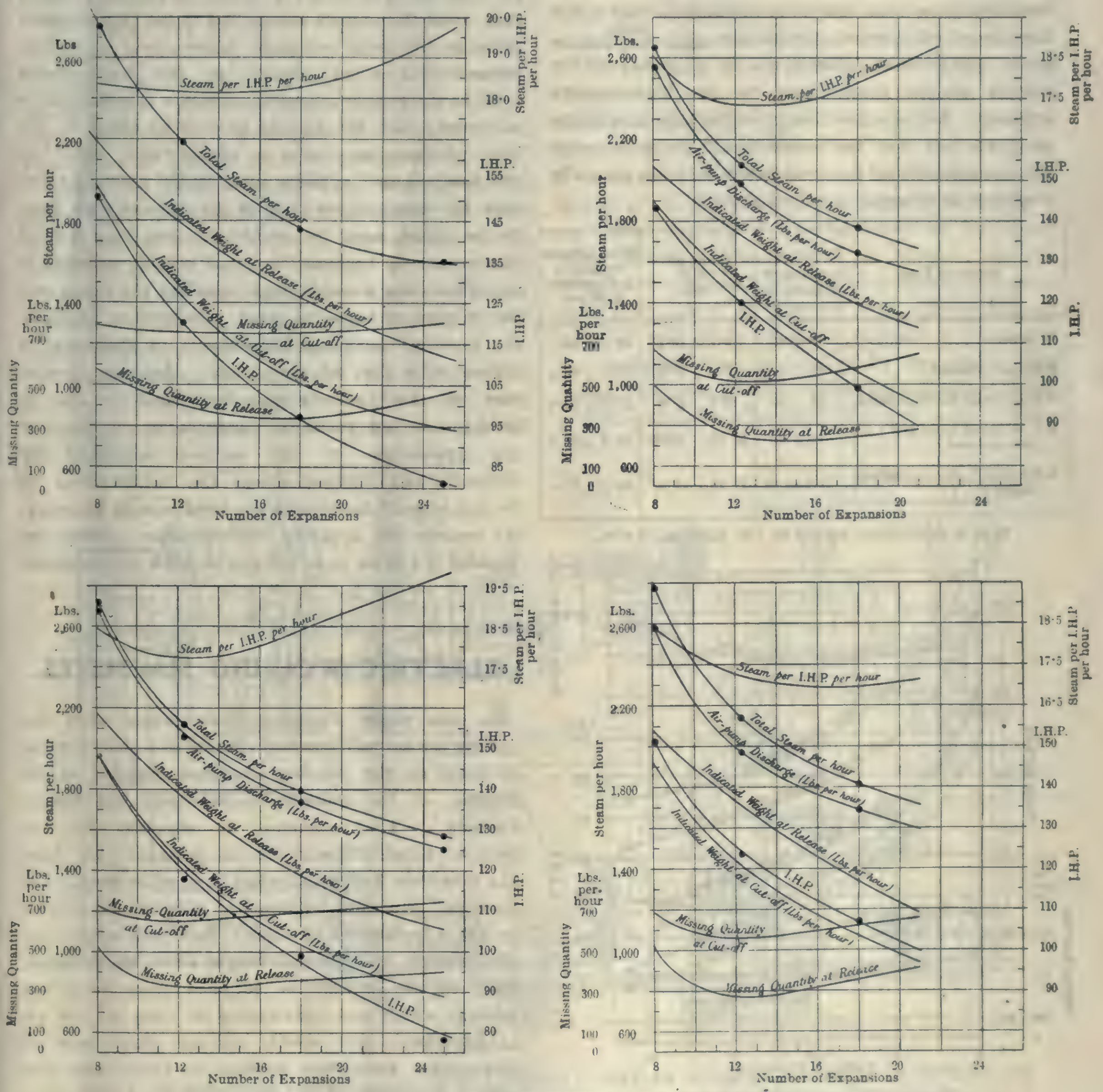
At each point of cut-off to run five trials with both cylinders unjacketed; with the ends of the high-pressure cylinder jacketed; with the ends and barrel of the high-pressure cylinder jacketed; with the ends and barrel of the high-pressure, and the ends of the low-pressure cylinder jacketed; with the ends and barrels of both high and low-pressure cylinders jacketed.

It will be seen that this gives five series of trials with various grades of expansion, and, if the range of expansion be sufficient, curves may be constructed from these trials which will determine the most economical number of expansions, and the consumption at that point for each series. From these curves the effect that jacketing has upon the economy can at once be determined, and the most efficient trials of the five series compared with one another. It seemed desirable that an attempt should be made not only to find out whether jacketing was efficient, but the reason for any efficiency it might have.

ENGINES AND JACKETING ARRANGEMENT.

The engines are of the horizontal compound side-by-side type, with high-pressure cylinder, 11½ in. diameter, low-pressure cylinder 20 in. diameter, and stroke 36 in. The high-pressure cylinder is provided with Corliss valves and gear, and the low-pressure with slide valves and Meyer expansion plates. The ends and sides of the cylinders are steam-jacketed. The jacket steam for both cylinders comes direct from the main steam-pipe without any intervening reducing valves, and there are separate supply pipes each with a shut-off valve leading to each end and each barrel jacket. This indicates the arrangement of the jacket supply, and drain pipes. In all the trials the steam-pressure in the jackets was practically equal to that at the high-pressure stop valve.

If the effect of steam-jacketing is to reduce initial cylinder condensation, it would appear that the best



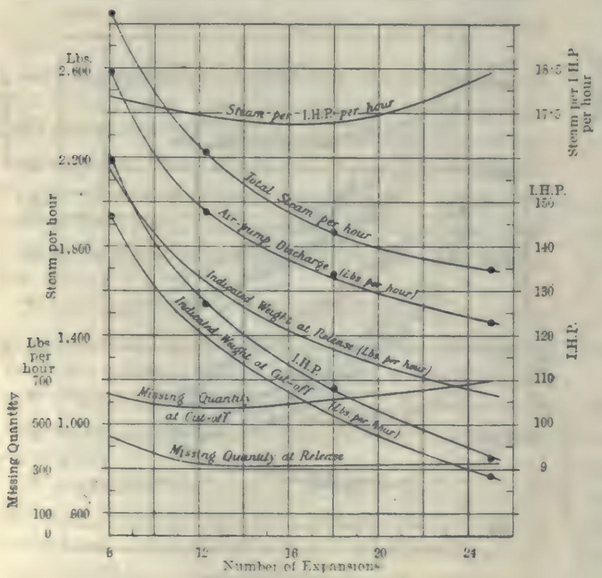
CURVES SHOWING THE MOST IMPORTANT RESULTS AND READINGS.

results ought to be obtained when the engine is running slowly. It was, therefore, decided to run the engine at about half its normal speed—a fact which ought to be remembered when comparing the results here given with those from engines of a similar type. Had the engine been working at its maximum speed, the consumption in terms of the indicated horse-power would have been much less.

The most important results and readings from the trials have been plotted in curves on this and preceding page. In these diagrams it will be seen that the base line taken is the total number of expansions, that is, it is the value of $r R$ where r is the fraction $\frac{\text{stroke}}{\text{Piston travel to cut-off}}$ in the high-pressure cylinder, and R is the ratio of the volume of the low-pressure to the high-pressure cylinder. No correction has been made for clearances as it was felt that the results would be more useful to engine builders if the terms used were those generally employed in everyday commercial work.

Nature of Trial.	Best number of Expansions.	Steam per I.H.P hour.	Steam pressure reduced to L.P. cylinder at 60 revs.
No jackets	11 to 17	18·1 to 18·2	38·2 to 30
H P. ends jacketed . .	11 ,, 14	17·7 ,, 17·8	37·8 ,, 33·5
H.P ends and barrel jacketed.	11 ,, 15	17·3 ,, 17·4	37·6 ,, 32·8
H.P. ends and barrel and L.P. ends jacketed . .	14 ,, 19	16·95 ,, 17·05	35·3 ,, 31·1
H.P. and L.P. ends and barrels jacketed . . .	13·4 to 19	17·25 ,, 17·35	36·6 ,, 31·4

TABLE SHOWING RESULTS OF EXPERIMENTS.



CURVE SHOWING SOME OF THE RESULTS AND READINGS.

RESULTS OF EXPERIMENTS.

The following is a summary of what appeared to be the most important results obtained from these trials. That compound engines with a boiler pressure of 150 lb. may be worked with a mean pressure referred to the low-pressure cylinder of about 40 lb. per square inch without any loss of efficiency in terms of the brake horse-power; that the jackets have their maximum efficiency when the whole of the high-pressure and the ends of the low-pressure cylinders are jacketed with high-pressure steam (see curves on this and preceding page); that when the jackets are applied to the high-pressure cylinder the total indicated horse-power is slightly reduced, but when applied to the low-pressure cylinder the total indicated horse-power is considerably increased; that the jackets have little effect in the high-pressure but have a considerable effect in the low-pressure cylinder upon initial condensation; that the temperature cycle of the cylinder walls next to the steam must be considerably less than that of the steam—(*a*) because the actual missing quantity is much less than it would have been had the steam and metal gone through the same temperature changes, (*b*) because the mean temperature of the metal is higher than that of the steam; that the greater part of the "missing quantity" must be due to leakage and not to initial condensation; (*a*) because the application of the methods suggested by Callendar and Nicolson shows the condensation to be but a small fraction of the total missing quantity, (*b*) because the apparent re-evaporation during expansion is less for jacketed than for unjacketed engines.

ELECTRIC WINDING MACHINES.

In this paper, Professor Paul Habets, after discussing the subject generally, describes a great number of trials on the winding machines installed at St. Nicolas, at the collieries of Espérance and Bonne-Fortune. The machine, as supplied by the Société Belge d'Electricité, is designed to draw 492 tons from a depth of 2,625 ft. in eight hours. The loads are: four tubs holding 535 kilogrammes of coal, or 750 kilogrammes of stone; each tub weighs 250 kilogrammes, and the cage weighs 1,800 kilogrammes. The electric energy is supplied from the power station, which was constructed in 1899, at the pit of Espérance, and which contains three sets of three-phase generators working at 1,000 volts, and with a frequency of 44, the output of each machine is 200 kilowatts. Two of the sets also supply current for pumping, ventilation, picking, etc., at the pits of Esperance and St. Nicolas; the third is a reserve set.

WINDING ENGINES AT ST. NICOLAS.

The coal is drawn from four underground landing stages at depths of 1,207 ft., 1,122 ft., 945 ft., and 607 ft. Under these conditions, the maximum haulage speed need not exceed 39 ft. 4½ in., in order to draw a total of 492 tons from a depth of 2,625 ft. When the depth is less or the tonnage is smaller, the speed may be slower. The haulage speed is 32 ft. 9⅜ in. when the motor makes 64 revolutions per minute.

Notwithstanding the high frequency, a three-phase motor might have been designed for this slow speed. Preference has, however, been given to a continuous-current motor; and a motor-generator of the Ilgner type, consisting of a three-phase motor, and a continuous-current generator has been adopted.

During the period of acceleration, the three-phase motor would have absorbed 615 h.p., a power which the central station would not have been able to supply with the present plant. Besides, a three-phase motor with a starting rheostat is very wasteful, and the loss of power in this case would have been still higher on account of the intermediate stoppages.

Notwithstanding the conversion of the three-phase current, the motor-generator is in this case more economical, as it almost entirely prevents any losses during acceleration, and the slow speed, which must be adopted when the haulage is reduced, and also during the night shift. A motor-generator with an Ilgner flywheel will also equalise the demand on the power station, no matter how the load varies. The power station will then be able to supply the other motors if the pumping is done during the night.

The haulage-motor M, fig. 1, is a separately excited continuous-current machine; its rated power is 320 h.p. at 64 revolutions per minute, and at 500 volts. It will carry an overload of 40 per cent. for half an hour, and of 100 per cent. for five minutes. It will reverse, without moving the carbon brushes, and gives no sparking even when the voltage is considerably reduced.

The terminals of the haulage motor, M, fig. 1, are electrically connected with the generator G1, of the Ilgner motor-generator M1 G1, and a maximum current release, which acts when the current reaches 1,500 amperes, is inserted in one of the leads. The output of the continuous-current generator, which is separately excited, is 650 kilowatts at 500 volts when making 285 revolutions per minute; the rise of temperature, measured by the increased resistance does not exceed 45 degrees. The carbon brushes have no lead, even when the machine is generating the maximum current required by the motor. The machine will also generate the current without sparking, at voltages varying between zero and ± 500. These

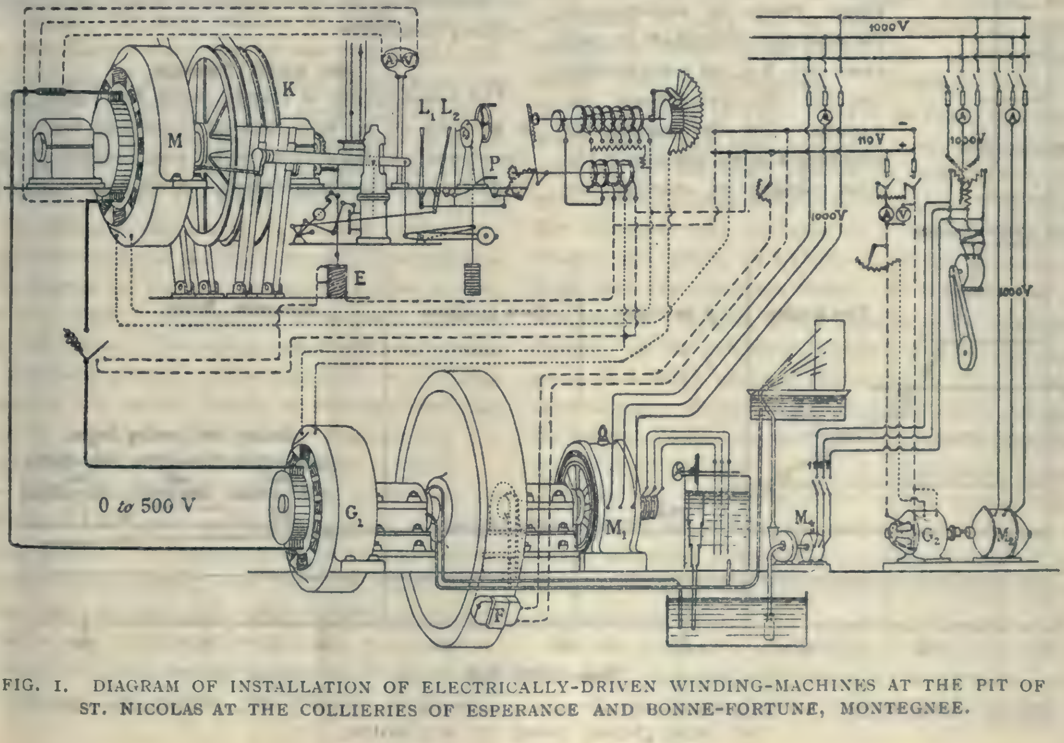


FIG. 1. DIAGRAM OF INSTALLATION OF ELECTRICALLY-DRIVEN WINDING-MACHINES AT THE PIT OF ST. NICOLAS AT THE COLLIERIES OF ESPERANCE AND BONNE-FORTUNE, MONTEGNEE.

results are due to the large proportions of the generator, whose power is more than double that of the haulage motor.

ELECTRICAL PLANT DESCRIBED.

The generator and the haulage motor are of similar design. The cast carcass carries the pole pieces of laminated iron, which are fixed by bolts in such a manner that they can be removed laterally without dismounting the armature. The field coils are protected by the carcass, and the bobbins are divided into section for the purpose of ventilation. The armature is a drum, the conductors being tooled and placed in the grooves of the sheet-iron core; the openings between the conductors allow of an effective cooling by circulation of air.

The haulage motor M and the generator G1 are both excited by a small motor generator M2-G2, which supplies a continuous current at 110 volts. This motor-generator consists of a 27 h.p. asynchronous motor M2, supplied with current from the power station and making 820 revolutions per minute, and an 18-kilowatt continuous-current shunt-generator, G2.

The armature of the main generator, G1, is mounted on the end of the shaft, which also carries, between its two bearings, a flywheel of cast-steel, 4 metres (13 ft. 1½ in.) in diameter, and weighing 40 tonnes (39·3 tons). The rotor of the asynchronous motor M1, which drives the Ilgner group, is mounted on the other end of the shaft; it will exert 250 h.p., at a continuous run of 285 revolutions per minute. For the purpose of inserting a liquid rheostat in the rotor circuits, on starting the machine, the rotor is provided with slip rings. A electro-magnet brake, F, when excited, will generate eddy currents in a flywheel rim, and will stop the motor-generator in about a quarter of an hour. Without this contrivance it would take several hours to bring the machines to a standstill on account of the large amount of energy stored in the flywheel.

The reversing of the haulage motor is brought about by manipulating the lever L1 of a controller. According to the position of the lever, the following will take place; simultaneous reversing of the field current of the generator G1, and the haulage motor M, reducing the field current of the haulage motor and interrupting the field circuit of the generator when the motor is stopped; increasing the field current of the generator progressively by cutting resistances out and thus causing the voltage of the generator as well as the speed of the motor M to increase progressively. When the lever L1 is turned back towards the position "stop," the motor will become a generator, and will act as a brake. The Koepe pulley, K, is provided with two brake rims.

The apparatus as well as the electrical connections are shown in fig. 1.

The haulage machine has been submitted to a series of trials with the object of giving an account of the performance of the Ilgner system; also of testing the consumption guaranteed by the contractor, and finally by determining the consumption of energy under actual working conditions.

NO LOAD TRIALS.

The consumption of energy, while the Ilgner group is working on no load, has an important bearing on the economy of the system, and it was therefore decided to determine this consumption. A Siemens wattmete

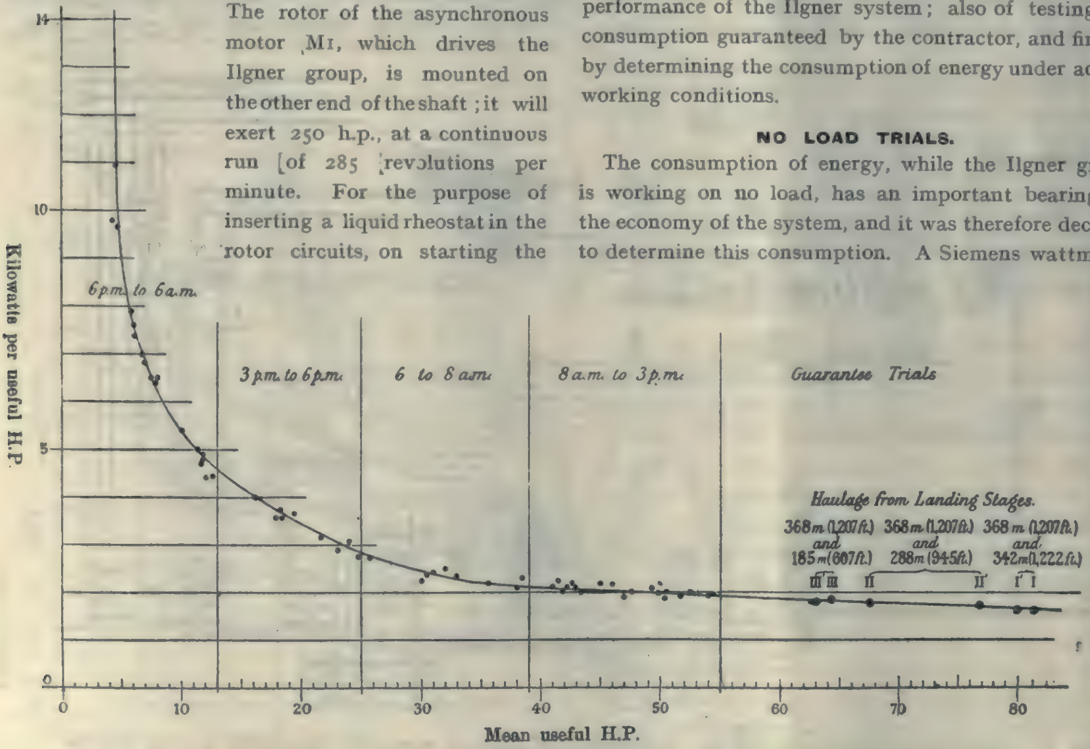


FIG. 2. CONSUMPTION IN KILOWATT-HOURS PER H.P.-HOUR IN RAISING COAL, CORRESPONDING TO MEAN WORK DONE IN H.P.-HOURS.

and an electricity-meter were inserted in one of the motor-leads (M1), and readings taken were every five minutes during a period of 35 minutes, the machine making 313 revolutions per minute. According to the readings of the wattmeter, which had been specially standardised, the consumption was 31·94 kilowatt hours; the electricity-meter showed a consumption of 30·85 kilowatt hours. The temperature of the oil on the bearings was 30·8 degrees C. (87·4 degrees F.). By stopping the circulation of water for 4½ hours, the temperature of the oil on the bearings rose to 45·5 degrees C. (113·9 degrees F.); under these circumstances and the shaft making 315·5 revolutions per minute, the consumption according to the wattmeter and the electricity-meter was 30·55 kilowatt hours, and 29·82 kilowatt hours respectively. According to another trial, repeated on January 29th, the consumption was found to be 28 kilowatt hours at a speed of 314 revolutions per minute; the temperature of the oil was 35·7 degrees C. (96·3 degrees F.). The latter consumption corresponds to that guaranteed by the contractor. The efficiency of the motor at this reduced load was 0·6; the windage of the Ilgner group and the friction between the journals and the bearings absorbed, therefore, about 17 kilowatt hours.

UNDER WORKING CONDITIONS.

For the purpose of determining the consumption in kilowatts per useful h.p., the haulage machine at the pits of St. Nicolas has been submitted to a permanent set of trials. The large number of results from the trials, which lasted over a period of one month and a half, have been plotted (fig. 2) by taking as ordinates the consumption in kilowatts per useful horse-power, and as abscissæ the mean useful horse-power given off by the machine. The points lie evidently on an hyperbolic curve. During the night, when the haulage is less, the ordinates are longer on account of the permanent consumption of the Ilgner group. The ordinates will be shorter as the haulage becomes more active, and will be about 2 kilowatts per horse-power between 8 a.m. and 3 p.m. The results from the guaranty trials have also been plotted; these points lie on the continuation of the curve. It may be remarked that the hyperbolic curve is similar to that representing the consumption of a steam-driven winding machine.

The high consumption during the night may be attributed to the Ilgner system, and would therefore not take place if the winding machine were driven by an asynchronous motor; but then one would have to take into account the consumption of energy required to keep a dynamo at work at the power-station which should be large enough to generate the maximum power required for starting the winding machinery. In the instance of the machine at pit No. II. Preussen the author has shown that the variation of consumption of a winding machine driven by an asynchronous motor follows also an hyperbolic law.

It may safely be concluded from these trials that the electric haulage machine, even if it is not more economical than the best steam-driven machine, is certainly not more expensive. The greater facility and safety with which it can be manipulated, the smoothness with which it works, and its much greater flexibility, will often make it preferable to the steam-driven machine, even in the case where transmission of energy is not required. There can be no hesitation in the choice between the two systems, when the power has to be transmitted from a distance, or, as is the case of the pits of St. Nicolas, where the production of energy can be centralised at one power station.

THE STRENGTH OF COLUMNS.

A paper on this subject was read by Professor W. E. Lilly, of which the following is an abstract:—

The design of a column of a given length to carry a given load involves the determination of the area and radius of gyration of its cross section and thus indirectly of its thickness. The formulæ in general use do not take into consideration the ratio to be adopted between these quantities, it being left to the designer to assume empirically some values which seem most suitable under the circumstances. Considered from a theoretical point of view, there is for every column of given length and load a definite area and radius of gyration for the most economical cross-section, and any departure from these involves waste of material. For instance, take the case of a hollow mild-steel column of circular cross-section, if the diameter is large and the thickness small, the column fails by wrinkling of the sides of the column or by secondary flexure; if the diameter is small and the thickness great, if fails by primary flexure or bending; hence there is some diameter and thickness which will give the most economical result. The experiments described were carried out with a view of determining experimentally the conditions under which failure takes place either by primary or secondary flexure and to obtain indirectly some definite information as to the values of the areas and radii of gyration of the economic cross-sections.

For this purpose it was decided to test a number of mild-steel tubes similar to those now so generally used in cycle construction, and of as nearly as possible a uniform quality throughout. Table I. gives the diameters and gauges of the tubes :—

TABLE I.

External Diameter.	Thickness, Standard Wire Gauge.					
inch.						
$\frac{3}{8}$	16	17	18	19	20	22
$\frac{7}{16}$	16	17	18	19	21	22
$\frac{1}{2}$	17	18	19	20		
$\frac{5}{8}$	18	19	20			
$\frac{3}{4}$	18	19				
$\frac{7}{8}$	18	19				
1	18	19				

The dimensions of the tube having been ascertained, measured lengths were cut off ; these were then trued up in the lathe to ensure straightness, the ends at the same time being faced off square. Hard steel round-ended pins with square shoulders were fitted to the ends of the tubes as shown on fig. 1 ; they were then ready for testing.

TABLE II

External Diameter.	Internal Diameter.	t	ρ	Reference to Curves.
inch.	inch.			
1	0·92	0·04	0·34	F
0·875	0·78	0·048	0·3	E
0·75	0·636	0·057	0·25	D
0·625	0·481	0·072	0·2	C
0·5	0·3	0·1	0·15	B
0·4	0	0·2	0·1	A

GIVING PARTICULARS OF TUBES.

METHOD OF TESTING AND THE RESULTS.

The mode of testing was to place the tube vertically in the testing machine, the round ends bearing on steel discs as shown on fig. 1, the surfaces being very slightly concave to enable the specimen to be easily adjusted. The test was then carried out in the usual manner and the load producing failure noted.

The number of experiments carried out on various lengths of tubing exceeded eight hundred ; of these only a selection is given on figs. 2–8, which bear more directly on the investigation.

The results averaged, giving a close approximation to the curves of the tubes shown on figs. 2–10.

The data given on the diagrams, figs. 2–8, refer to the individual tubes tested. On the base line values of l, the length, divided by ρ the radius of gyration are plotted, the breaking load for these values being plotted vetrically. The numerical value of the diameter $= d$, standard wire gauge $= g$, area of cross section $= A$, radius of gyration $= \rho$, and the thickness $= t$ of the tube, are given on each diagram respectively. The curves on fig. 9 show the influence of the thickness in determining the load which produces failure ; they have been deduced from the curve shown on figs. 2–8, the diameter and thickness of the tube being varied and the area of the cross section kept constant, the uppermost curve of the series being for the limiting case when the tube becomes a solid bar. If now the curves on fig. 9 be plotted with the base lines representing length and the breaking load for these values vertically, a series of curves is obtained as shown on fig. 10 ; from the inspection of these the influence of the diameter and thickness upon the length is very clearly shown, and from which it will be seen that the economic ratio of the diameter and thickness for a given cross section depends upon the length of the column.

EXPERIMENTAL DIFFICULTIES.

The breaking strength to tension of several specimens, cut from the tubes under test was determined, giving results which varied from 62,000 lb. to 85,000 lb. per square inch ; the average of these tests was nearly 72,000 lb. per square inch.

The determination of the strength to compression of the mild-steel tubing, that is, the strength of very short specimens, was a matter of some difficulty owing to the bulging and upsetting of the specimens when thick, and to the wrinkling or doubling up of the

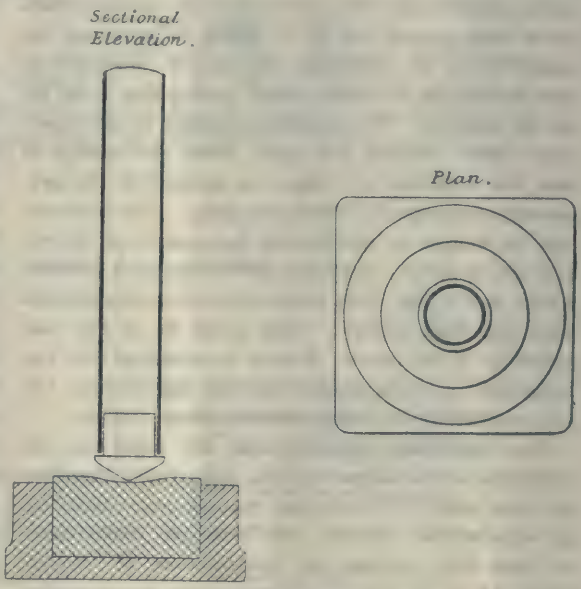


FIG 1—TUBE READY FOR TESTING FITTED WITH HARD STEEL PIN AND BEARING ON STEEL DISC.

specimens when thin; the average of the breaking strengths to compression was 80,000 lb. per square inch. This value has been adopted throughout in plotting the curves in figs. 9 and 10.

Experiments were also made for the determination of Young's modulus of elasticity, and gave an average value of 30,000,000 lb. per square inch; this value has been adopted throughout in plotting the curves on figs. 9 and 10.

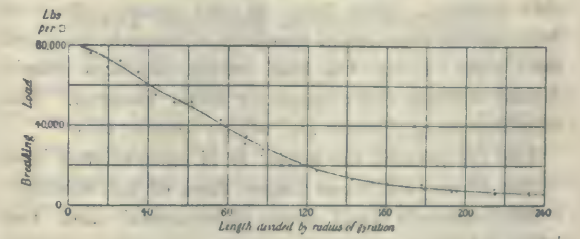
The following phenomena were observed during the carrying out of the tests. When the failure of the column takes place by secondary flexure for a large range of the length, there is little variation in the breaking load. Hodgkinson, in his experiments on wrought-iron columns has previously remarked on this.

As the load approached the breaking load, there was on the short lengths a decided yielding of the tube before failure.

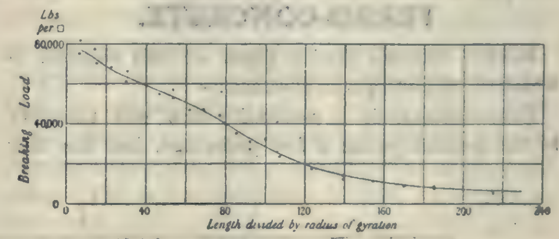
The experimental work on columns hitherto carried out has been incomplete, owing to the limited range of the experiments; this has led to considerable diversity of opinion, more especially by American observers, as to the value of the constants that should be used in the Rankine-Gordon formula. This is to be expected in view of the results of this investigation, many of the experiments being made on columns of different proportions, and the results varied with different values for the constants in each case.

The general formula applies to columns of mild steel and wrought iron; the constants for wrought iron given by Rankine are f=36,000 lb. and $c=\frac{1}{9000}$ for columns with round ends. Assuming the strength of the wrought iron to compression to be 24 to 25 tons per square inch this formula gives a value of d/t of about 16 and for ρ/t of 5·5 to 6. Now these constants were derived from Hodgkinson's experiments on columns, of which the average ratio of d/t was approximately 16; hence the formula may be looked upon as being confirmed by these experiments. For the ordinary ratios of ρ/t in practice the Rankine-Gordon formula gives fair results; it does not however, apply with the same accuracy to solid bars or columns in which the ratio of ρ/t is large; this will be evidenced from the inspection of the curves on fig. 9. One of these for which f = 42,000 lb. gives good average values; the remaining curves giving values which are either too high or too low respectively for values of l/ρ, at which failure takes place by elastic bending. This discrepancy arises from the fact that in the formula ρ varies directly with f, that is, the load which a column will carry is supposed to be proportional to the strength of the material; this is not true for long

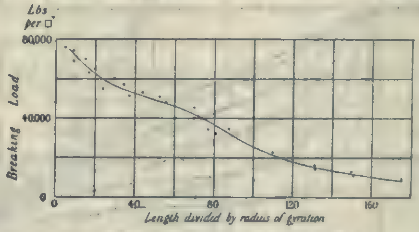
Diameter, $d = \frac{3}{8}$ in. Standard Wire Gauge, $g = 16$.
Area of Cross Section, $A = 0{\cdot}063$ sq. in. Radius of gyration, $\rho = 0{\cdot}11$
Thickness of Tube, $t = 0{\cdot}17\,d$. $(\rho/t)^2 = 3$.



$d = \frac{7}{16}$ in. $g = 16$. $A = 0{\cdot}076$ sq. in. $\rho = 0{\cdot}13$ $t = 0{\cdot}14\,d$. $(\rho/t)^2 = 4{\cdot}8$.

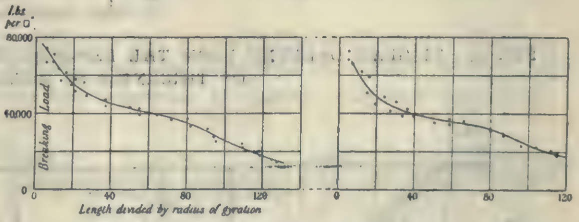


$d = \frac{1}{2}$ in. $g = 17$. $A = 0{\cdot}077$ sq. in. $\rho = 0{\cdot}16$. $t = 0{\cdot}11\,d$. $(\rho/t)^2 = 8{\cdot}3$.



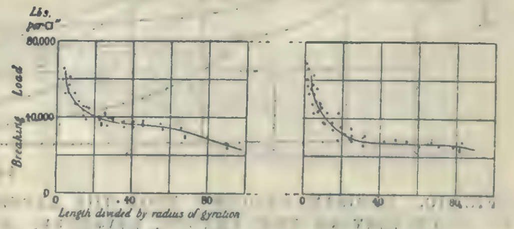
$d = \frac{5}{8}$ in. $g = 18$. $A = 0{\cdot}086$ sq. in. $\rho = 0{\cdot}21$. $t = 0{\cdot}077\,d$. $(\rho/t)^2 = 19$.

$d = \frac{3}{4}$ in. $g = 18$. $A = 0{\cdot}107$ sq. in. $\rho = 0{\cdot}25$. $t = 0{\cdot}065\,d$. $(\rho/t)^2 = 27$.



$d = \frac{7}{8}$ in. $g = 19$. $A = 0{\cdot}11$ sq. in. $\rho = 0{\cdot}31$, $t = 0{\cdot}046\,d$. $(\rho/t)^2 = 60$.

$d = 1$ in. $g = 19$. $A = 0{\cdot}12$ sq. in. $\rho = 0{\cdot}34$. $t = 0{\cdot}04\,d$. $(\rho/t)^2 = 72$.



FIGS 2 TO 8. SHOWING SELECTED RESULTS OF THE INVESTIGATION.

columns; it is the modulus of elasticity which governs its strength, and it is the constant *c* which involves this quantity. Now there is not much difference between the modulus of elasticity of wrought iron and mild steel; hence the load which produces elastic failure will not differ much for either material. The experiments of Christie and others confirm this.

For the present the writer is of opinion that it is better to use the better known form of the Rankine-Gordon formula until more experimental data has been obtained.

FERRO-CONCRETE.

M. Ed. Noaillon read a paper on this subject, of which the following is an abstract :—

Ferro-concrete is a material which was unknown to the general public a few years ago, but has now entered with phenomenal rapidity into all branches of constructional work. This result is due to the economy rendered possible by its use as compared with other competitive systems; to its resistance to fire, which is now put beyond doubt by numerous tests; to the fact that it is unaffected by atmospheric action; the ease with which the material may be made to take any desired form; its homogeneity; its rapidity of execution, impermeability, and great rigidity.

The material is an agglomerate of hard stones bound together with cement. According to the nature of the work, the concrete contains from 350 lb. to 700 lb. per cubic yard.

In systems of construction where the metal framework can carry by itself the whole load and where concrete is merely intended to protect the metal, to fix it, and to hold its different parts together, then

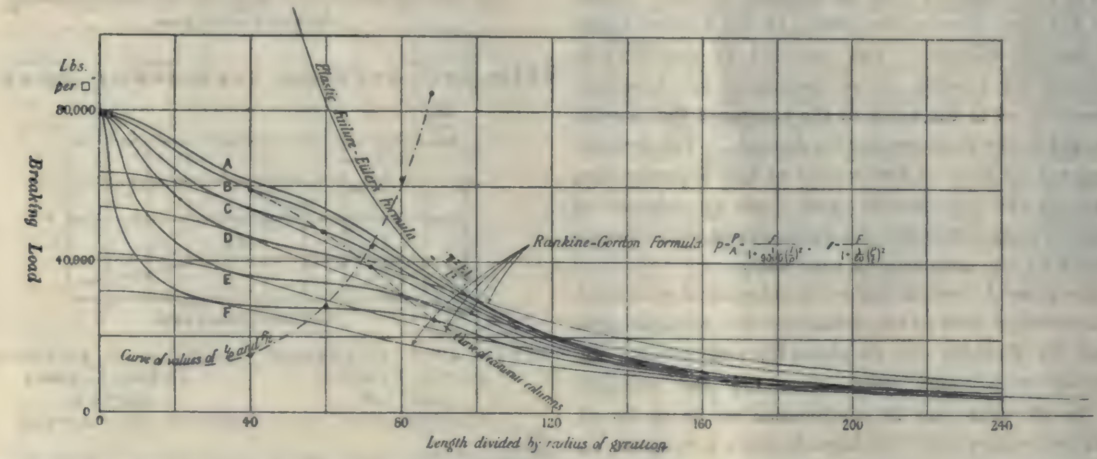


FIG. 9. DIAGRAM DEDUCED FROM THE EXPERIMENTS ON MILD STEEL TUBES SHOWING THE INFLUENCE OF THICKNESS IN DETERMINING THEIR FAILURE.

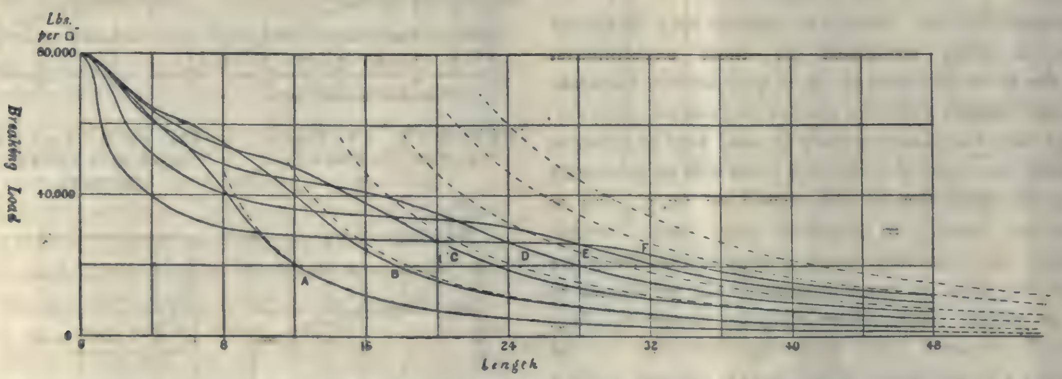


FIG. 10. DIAGRAM DEDUCED FROM THE EXPERIMENTS ON MILD STEEL TUBES SHOWING THE EFFECT OF VARYING THE LENGTH, DIAMETER, AND THICKNESS ON THEIR FAILURE, THE AREA OF THE CROSS-SECTION BEING CONSTANT.

the quantity of cement may be reduced to the minimum, and the gravel may be replaced by slag or by coke breeze. The concrete is far weaker than the other, but it is less expensive, lighter, more refractory and more sound proof, and nails can be driven into it.

At the present time the metal almost exclusively employed is mild steel with an ultimate tensile strength of 27 tons per square inch. This costs no more than iron, and has the advantage of possessing a greater tensile strength and a higher co-efficient of elasticity than the latter metal.

The construction of the centring is the most important part in the employment of structures in ferro-concrete. It takes up the most time, and seriously enhances the cost of the work. Certain systems reduce or even obviate altogether the use of centring by the employment of metal work of sufficient strength or pieces of concrete specially made for the purpose.

It is not possible by a simple examination to ascertain the strength of a finished structure in ferro-concrete, for the metallic members are no longer visible and their precise size and position cannot be gauged. The only method is to measure the deflection of the structure under given loads. The results obtained are however, not precise, and useful information can only be gained by comparing similar structures. The deflections of structures in ferro-concrete are much less than those which would be given by a structure of equal strength built of wrought iron; for when concrete is stressed up to its elastic limit its deflection is less than that of iron under similar conditions.

Professor Rabut has summed up in the following six rules the principles which experience and theory recommend should be followed in the construction of ferro-concrete buildings :—

No connections should be made of iron to iron, as the concrete itself holds the parts together in the most economical manner.

At least two distinct systems of re-inforcement should be used, the one system to take up the tensile stress, and the other to take up the shearing stresses in the concrete; when it is necessary a third system should be used to take up the compressive stresses. The re-inforcement should be so arranged that the separate members may be stressed in the direction of their length, so that the stresses produced between the iron and the concrete shall be tangential and not normal to the axis of the members of the reinforcement.

The component parts of a ferro-concrete structure may be classed under three headings. They are the parts which resist tensile stresses; those which resist compressive stresses; and those which resist more complex stresses.

PARTS RESISTING BENDING STRESSES.

These comprise chiefly the beams and the platform beams. In the majority of cases the beam supports a platform which is solid with it, and can therefore be used as a framework in compression; and this is one of the most characteristic properties of ferro-concrete. The materials are used in the most rational manner, the concrete of the platform is subject to compression and the metal resists tension; but this specialisation of work is only possible owing to the adhesion of the concrete to the metal. In reality there are forces tending to produce sliding, and these are proportional to the shearing forces, and therefore attain their maximum value near the supports. These forces tend to shear the concrete of the rib, and are concentrated at the contact surface of the concrete and metal. The mutual adhesion of these two materials has a very great importance, and it is well to bear this in mind.

Numerous tests have shown that in a carefully built structure this adhesion is not of lower value than the shearing co-efficient of the concrete itself. It has been stated that the adhesion was illusory, and that in reality the effect was merely due to a high co-efficient of friction between the iron and the concrete which compressed it in shrinking. But the fact that beams subject for lengthened periods to incessant vibration, such as those in the floors of flour mills, have remained sound tends to prove that the adhesion is real and lasting. Special tests have always given reassuring results, except when they have been made upon flat contact surfaces.

Adhesion does not only assist in resistance to shearing stresses, but the variations in relative volumes of the two materials in contact must be considered;

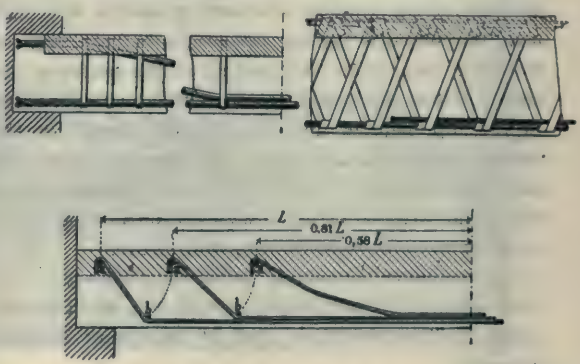


FIG. I. BEAMS ON HENNEBIQUE, PERRAUD AND DUMAS SYSTEM AND NOAILLON SYSTEMS.

these variations being caused by change of temperature or by shrinkage of the concrete.

TEMPERATURE WITHOUT INFLUENCE.

Temperature has no influence, for the co-efficients of expansion of iron and concrete are practically the same. When concrete sets in air it contracts, and therefore may produce considerable initial compression upon the embedded metal whilst being itself subject to an equivalent tensile stress. When the concrete sets under water the opposite effect is produced; the concrete expands and puts the metal in tension.

It is important that the shearing stress should neither overcome the adhesion of the metal to the concrete nor shear the rib of the beam.

To fulfil the first condition it is necessary to form the metal framework of such a number of bars that their surfaces in contact with the concrete shall be large enough, and in consequence the chance of surface slips shall be reduced. To avoid shearing of the rib special stirrup-shaped bars are used which join together the two members. This stirrup consists of a flat bent bar with the two ends bent in the form of claws, allowing it to hook itself solidly into the floor structure. The use of the flat bar in preference to the round bar facilitates the construction. In the Coignet system there is an upper iron framework.

Another means of resisting sliding consists in omitting horizontal bars in tension, and substituting bars fixed obliquely in the webs and rising to the floor structure at the ends of the beam.

CONTINUITY OF STRUCTURE A CHARACTERISTIC.

The author has pointed out that one of the characteristics of concrete is to lend itself easily to continuity of structure; but it is clear that this may have the effect of displacing, towards the bottom, the diagram of the bending moments in such a way that near the supports certain reversed moments may be of higher value than the moment at the centre of the span. From this cause tensile stresses are produced in the top member and compression stresses in the bottom member. In order to overcome the first set it is necessary to provide new re-inforcement if it does not exist in the upper member, or raise the lower re-inforcement towards the top of the beam.

To overcome the second series the concrete of the lower part of the web is often insufficient, and then the lower re-inforcement is used at this point in compression

The author of this paper desires to advocate a simple system which affords a re-inforcement of canal resistance and offers every security for resistance to sliding. Fig. 1 shows its application to a beam without fixed ends. For a span of moderate amount the re-inforcement consists of bars of three different lengths. Beams on the Hennebique and Perraud and Dumas systems are also illustrated in fig. 1.

Monsieur Considère has shown that ferro-concrete can extend without cracking until the re-inforcement reaches its limit of elasticity, and that the part of the resistance due to the concrete attains after the first extensions a value which remains constant until rupture occurs.

In practice this is never fully realised.

It is therefore obvious that the theoretical calculation of floor structures can only have a relative value, and that the co-efficients which are used in these formulæ ought to be obtained from practice.

When it is a question of covering a surface approximately square—a case which occurs frequently in houses—there is a great advantage in making the two systems of bars of equal strength, so as to make use of all four sides ot the space as supports.

A simple arrangement for surfaces of small dimensions consists in the use of expended metal as the re-inforcement; perfect security is then obtained for the necessary adhesion, and a poor concrete may be employed. This method of construction can be recommended for foundation blocks.

METHODS OF REINFORCING AGAINST COMPRESSION.

Columns are usually made of square section to facilitate centring; as a rule the reinforcement consists of four longitudinal bars placed near the four angles, and joined at intervals by cross ties. The ties are intended to prevent the buckling of the individual bars, and also serve to retain them in position during the filling of the concrete. The cross ties consist of plates or round bars which surround the longitudinal bars. Sometimes they are twisted round each bar, or plates with holes may be threaded upon the bars. The calculation of the re-inforcement is empirical, for the determination of the strain is first of all affected by the uncertainty regarding the law of deformation of the concrete, since it is directly proportional to the latter. Besides this the shrinkage of the cement communicates to the metal an initial compression which is often very considerable, but impossible to value beforehand. Moreover the bars also assist in resisting the tendency to buckling of the entire column, but the buckling is proportional to the co-efficient of elasticity of the column, and this value varies with the load, and is very different for the same load according as the preceding load has been greater or less than the load under consideration.

The resistance to buckling and to crushing is much increased by the use of a concrete very rich in cement, gauged with only a small quantity of water and well rammed. The methods of re-inforcing concrete against compression have been revolutionised by the introduction of the banded concrete invented by M. Considère.

It is safe to prophesy that banded concrete will be able in a large number of cases to replace with advantage the compression members made of rolled steel sections in a large metallic structure. The tension members would consist of bundles of round bars lightly banded and dipped in concrete. The connections would be more easily made than those of other frameworks, and could be re-inforced by a supplementary banding. Such structures would have an unlimited life with practically no expense for maintenance.

In this connection M. Considère has constructed and tested with complete success a bridge of 65·6 feet span entirely built of banded concrete.

An important application of banded concrete has come into ordinary use for piles. Such piles are stronger than those of wood, and have the enormous advantage that they do not rot.

PARTS SUBMITTED TO COMPLEX STRESSES.

The most important type of these pieces is the vault, in which the re-inforcement is specially designed to resist bending stresses caused by non-symmetrical or concentrated loads, whilst the concrete supports in compression those that are fixed and distributed.

The greatest uncertainty exists as to the most rational method of re-inforcing a concrete vault; the calculation of the re-inforcement is only rendered possible by the use of empirical co-efficients.

As has been seen from the preceding remarks it is most frequently impossible to determine accurately by means of theoretical formulæ the actual cross-sections of the re-inforcement.

The best guide is experience translated as well as possible into empirical rules. These rules will be all the more reliable according as they are based upon a larger number of structures, and from this point of view it is best to prefer the systems which have been the most employed in practice.

WE regret to hear that Mr. E. Windsor Richards and Mr E. P. Martin met with a nasty accident last week whilst motoring in the neighbourhood of Paris. The Ironmonger states that as they were driving from Nemours, Mr. Windsor Richards, who was acting as chauffeur, noticed the cart of a market-gardener ahead of him. He sounded the horn, but the driver of the cart kept on its course, leaving little room for the motor-car to pass. Mr. Richards, overtaking the cart at a bend in the road, attempted to pass it, but unfortunately he took too sharp a turn, with the result that the car crashed into the cart and bowled it clean over. The automobilists, who included M. E. Coppée, of Brussels, were hurled into the road, Mr. Richards and M. Coppée being badly cut about the head, the former gentleman having to be conveyed to the Hospital of St. Jean de Dieu. Mr. Martin escaped apparently without injury. Later reports stated that Mr. Richards is progressing favourably.

Incorporated Municipal Electrical Association.

THE tenth annual meeting of this Association was opened in Edinburgh on Tuesday last when Mr. Frank A. Newington delivered the presidential address, of which the following is an abstract :—

PRESIDENTIAL ADDRESS.

Municipal electrical undertakings are working under different conditions to companies. Electric supply companies have a definite number of years forty-two in most cases, during which they are given statutory powers to supply electricity in a given area, but at the end of that period the local authority can buy up the undertaking, not as a going concern, but simply at the then value of the plant. Municipal undertakings are much more advantageously situated.

There is another side, however, and the question of depreciation, which must be kept in view. It would be very unwise to say that the type of machinery in use to-day will also be installed twenty or thirty years hence. But unless some entirely new method of generating electricity is discovered, any improvements that can be made in either steam or gas engines would not warrant the displacement of the present very efficient steam engine. With coal costing about ¼d. per unit (and this figure we are all gradually reaching) enormous economies would have to be obtained with any new method of generation before it would pay us to do away with our present machinery.

But we must not forget that we may have to face some altogether new form of artificial illuminant, and therefore it would seem a sound business policy to form a depreciation fund over and above a reserve fund in order to meet an emergency of this kind.

At the start of an electricity supply undertaking the output is frequently under-estimated, and so small units of machinery are put down. After a few years these are found to be inconvenient to work, although still quite suitable in other respects. Second-hand plant of this kind seems to have an extremely small value, in fact, very little more than the value of the material, unless a purchaser can be found who wants exactly this kind of machinery. Plant of this description therefore may depreciate in value very rapidly. This also should be provided for by means of a depreciation fund.

In connection with the finance of municipal electrical undertakings, it is exceedingly satisfactory to notice how many more towns are now making a profit, and in many instances large profits, as compared with a few years ago.

Gas experts have succeeded in very much improving the incandescent gas mantle, so much so, that it is now very suitable for the lighting of streets where a large amount of light is not necessary, and where therefore arc lamps would be too powerful. Just at present there does not seem to be any form of electric lamp that can quite compete with the incandescent gas mantle for this purpose. There are some new forms of electric lamps more or less in the experimental stage at present that appear to be very promising as they are exceedingly economical. We may, therefore, very soon expect to have a lamp that can be used for side street lighting at a less cost than the incandescent gas mantle.

During the last ten or twelve years enormous improvements have been made in the manufacture of machinery for generating electricity, but unfortunately very little if any advance has been made in the wiring of houses or other buildings for electric light. This work as a rule does not come directly under our care, but it is a matter that may very seriously affect municipal engineers.

The present position of supply authorities as regards the power to enforce wiring regulations is vague and unsatisfactory, and the Council are now considering this matter with the view of asking the Board of Trade to sanction wiring regulations which will as far as possible insure the safety of the public from the risk of fire.

One of the aims of a municipal electrical undertaking is to utilise the machinery during the day-time as much as possible, and therefore electricity for power or heating purposes is sold at a low rate. But there is a weak point in this arrangement. The motors are used during the time of maximum lighting load during the winter months and, therefore, additional machinery must be provided for them. If it can be arranged for the motors to be switched off during the two or three hours of maximum load for lighting in the four winter months, extra machinery will not be required, and so a very low rate can be charged. This system is just now being adopted in Edinburgh, and is also in force in a few other cities.

On analysing the consumption of electricity by motors, it is generally found that the load factor is extremely low. Figures dealing with Edinburgh make it clear that the total power used at any one time is not half the power installed, and so the hours per day can at least be doubled, but even then the load factor would not be good. As the cost of generating electricity will be in inverse proportion to the load factor of the motors, this should be considered when fixing the price of electricity for power purposes. I would suggest that the members of this Association would be collecting very valuable data if they could find out how the motors connected to their system are used during the hours of maximum lighting load in the winter months.

LOAD FACTOR—ITS EFFECT UPON AN ELECTRICITY STATION.

Mr. Alex. Sinclair submitted a paper on this subject, of which the following is an abstract :—

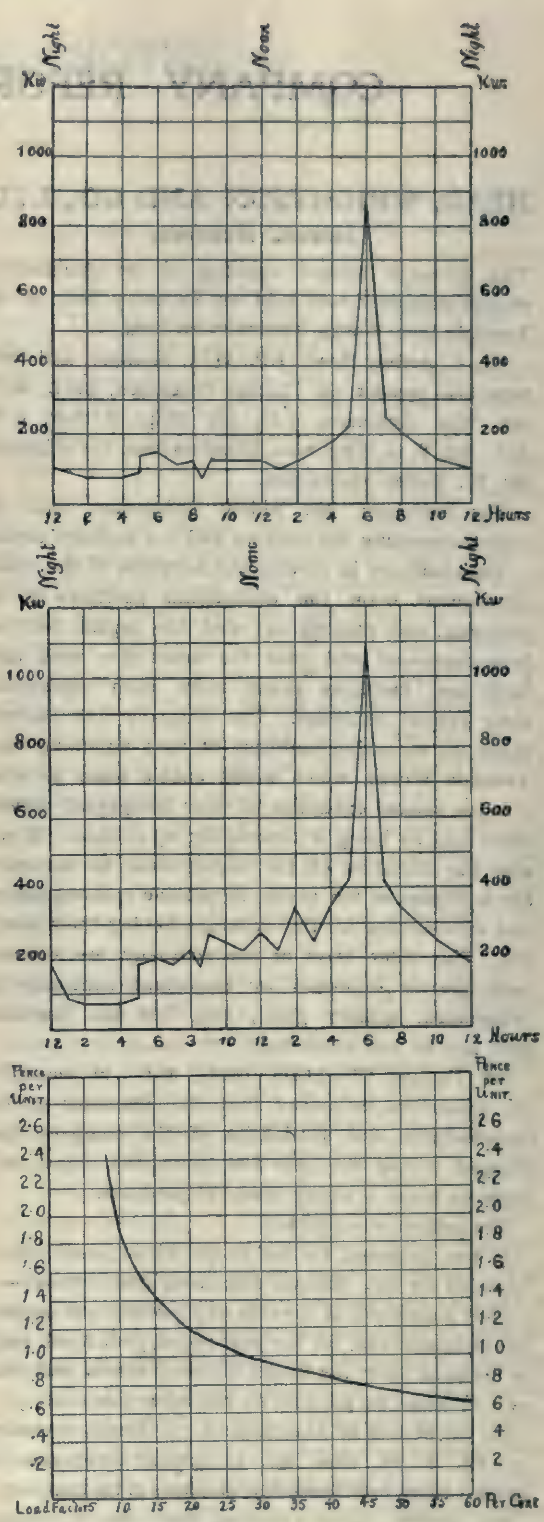
In compiling this paper the author keeps in view the great importance which the load factor of a station has upon its commercial success. Although lighting was in the first instance the reason for establishing an electricity undertaking, it is generally conceded that this alone can only hope for a certain measure of success. By adding customers who will take energy either for power or other purposes during the hours of light load the load factor is improved, with a result that the cost of generation per unit becomes decreased. Among desirable customers to assist in attaining this end are, public lighting, power and heat, and tramways companies.

Chart No. 1 shows the combination of lighting (private and public) and power, whilst No. 2 depicts the same with traction added. In the first example with 1,281,200 units and a maximum demand of 875 kilowatts the load factor is increased to 16·71 per cent., whilst in the other, having 2,207,570 units at 1,100 kilowatts the load factor becomes 23·14 per cent.

Chart No. 3 is an effort to depict the total charges, *i.e.*, works cost plus management, rent, taxes, insurance, etc., in pence per unit for factors ranging from 8 to 60 per cent.

It is clear that it is essential to the cheap generation of electricity to increase the load factor of a station by every possible means. Energy can be cheaply generated when so valuable a load factor as that of street lighting can be obtained, and the author thinks that this matter should receive far more attention in the future than it has had in the past. Thirdly, and on this point he lays particular stress, great hopes may be held out for the future of stations by dispensing power on a large scale to small users.

(*To be continued.*)



CHARTS 1, 2, AND 3 REFERRED TO IN PAPER ON LOAD FACTOR IN ADJOINING COLUMN.

COMPANY REPORTS AND MEETINGS.

HEAD, WRIGHTSON AND CO., LTD.

ANNUAL MEETING.

THE fifteenth annual meeting of the shareholders of this company was held on Saturday last, at the Teesdale Iron Works, Thornaby-on-Tees.

Mr. C Arthur Head, J.P., D.L., presided, and there were also present, Sir Thomas Wrightson, Bart., M.P., Mr. Wm Anderson, J.P., Sir Ralph Littler, C.B., K C Mr. T. G. Wrightson, directors; and the secretary, Mr. W. Ridley Makepeace.

The secretary, Mr. Ridley Makepeace, read the notice convening the meeting and the auditors' report.

The chairman in moving the adoption of the report commented upon the exceptional position of the company, and pointed out that the capital had not been increased and that the debts due with their land and buildings much more than represented their capital liabilities. The company had recently made an extensive purchase of land adjoining their Teesdale Works, which would enable them to make a much needed extension of their Bridgeyard department and so bring it thoroughly up-to-date. It was also the intention of the management, in extending the buildings of the works, to provide accommodation and convenience for the workmen having their meals, etc. The order book of the company has recently been greatly improved by important contracts for bridgework, colliery plant, etc., but the foundries were not so well employed.

Sir Thomas Wrightson, Bart., M.P., in seconding the resolution, intimated that the character of the manufactures and specialities of the company had changed during the past few years, the object now being to make a higher grade of products.

The motion was adopted.

It was proposed by Sir Ralph Littler, C.B., K.C., seconded by Mr. William Anderson, and carried:—

That a dividend at the rate of 7 per cent. per annum, free of income-tax, for the year ended, 30th April, 1905, be declared upon the issued ordinary shares, and that such dividend be payable on and after this date.

On the motion of Alderman A. G. Rudd, seconded by Mr. F. D. Wise, Mr. C. Arthur Head and Sir Ralph Littler were re-elected directors of the company.

Mr. Joseph Grey proposed and Mr. S. Young seconded, the re-election of Messrs. W. B. Peat and Co., as auditors of the company at the same remuneration as last year. The resolution was carried.

Mr. C. J. Archer proposed the following resolution:—

"That the directors be repaid all travelling, hotel and other expenses from time to time incurred by them when travelling to and from meetings of the company, or of the directors of the company, or of any committee or local board of the directors of the company (and that all payment heretofore made to the directors in respect of such travelling, hotel and other expenses be and the same are hereby confirmed)."

He stated in doing so that the resolution had become necessary in consequence of the recent decision of Mr. Justice Farwell, who has held that the usual clause contained in the Articles of Association of nearly every company, providing for the payment of the travelling and other expenses of the directors whilst engaged upon the business of the company, did not include payment of their expenses when travelling to or from the meetings of the company itself, or of the Board of directors. Mr. S. T. Coulson seconded the resolution which was carried unanimously.

Mr. G. B. Saunders, Newcastle, moved that the best thanks of the shareholders be presented to the directors and officials for their management of the company's business. Mr. W. H. Robinson seconded, and the motion was adopted unanimously.

GREENWOOD AND BATLEY, LTD.

The report of this well-known company for the year ending 31st March last, shows a profit, after payment of debenture interest, of £32,190, and adding the balance to credit of profit and loss brought in, the sum available for dividend amounts to £35,859. From this the directors have written off 7,500 for depreciation of plant, and have added £5,000 to the reserve fund, raising it to a total of £35,000. A dividend of 6 per cent. is recommended on the ordinary share capital, absorbing £17,333; leaving a balance of £6,026 to be carried forward. The balance-sheet indicates a satisfactory financial position, but in the absence of a detailed trading or profit and loss account it is difficult to analyse the figures. At the same time, the reasons for withholding the figures relating to the trading are well understood and have as their basis the best interests of the shareholders.

SHIPBUILDING NOTES.

AT Queen's Island, Belfast, on Saturday, Messrs. Harland and Wolff, Ltd., launched the large steel screw steamer *Mahronda*, the first of four steamers of similar dimensions which they are building to the order of Messrs. Thomas and John Brocklebank, Ltd., for their Liverpool-Calcutta service. The new vessel is 470 ft. long, by 58 ft. beam, and, when completed, will probably reach 8,000 tons gross register. She will have a deadweight carrying capacity of over 11,000 tons, and will thus be the largest cargo steamer in the Calcutta trade. The *Mahronda* will be provided with every facility for the rapid loading and discharging of cargo. The engines have been designed by Messrs. Harland and Wolff, Ltd., to enable the vessel when fully loaded to maintain a speed of 12 knots at sea, on a moderate consumption of coal, and it is expected that the passage to Calcutta will be made in probably less than twenty-eight days, including the time occupied in passing through the Suez Canal. The holds, five in number, are of prodigious capacity, the hatches being of such a size as to admit of the easy stowage of locomotive boilers, machinery, etc., of the largest dimensions. The owners have ordered four steamers of the *Mahronda* class, and it is expected that the remaining vessels will be launched in quick succession from Messrs. Harland and Wolff's yard.

In quoting statistics, showing that nearly half the tonnage passing through the Bosphorus is British, Mr. Waugh, in a recent consular report, remarks that Constantinople is the natural place for a dock, lying, as it does, on the direct road of the large Black Sea traffic. No adequate dock accommodation exists in the whole Eastern Mediterranean. During the last winter as many as five steamers at a time have been waiting at Constantinople for the chance of getting into dock for repairs. He suggests that, in the interests of British shipping, suitable dock accommodation should be provided at the port. A dock company started with a moderate capital of, say, £100,000 could reckon on constant work during the winter for repairs, and on continual work during the summer for painting and cleaning, provided its charges were moderate. It would not be difficult to find a suitable site if the Turkish Government could be persuaded to grant a concession. Failing permission to construct a proper dry dock, a floating dock might be better than nothing.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Monday, the steel screw trawler *Cyrano*, the principal dimensions being 117 ft., by 21 ft. 6 in., by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Alec. L. Black, Esq., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes.

On the 19th inst., Messrs. William Gray and Company, Ltd., launched the steel screw steamer *Manchuria*, for Messrs. Metcalfe, Simpson and Co., West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions: Length overall 342 ft., breadth 6 ft., and depth 24 ft. 14 in., with long bridge, poop, and topgallant forecastle. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in., diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 160 lb. per square inch.

On the 17th inst. the s.s. *Tiberius* was launched from the yard of the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, this being the second vessel built for Mr. C. Anderson, of Hamburg. The steamer is 372 ft. long, by 48 ft. beam, by 30 ft. 10 in. deep, and has been built under special survey to the highest class at Lloyd's Spar Deck Rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, top-gallant forecastle; the accommodation, which is very ample, being all placed in steel houses on the bridge deck. The 'tween decks are lofty, and so arranged that cattle, troops, or emigrants may be carried if necessary. She has been constructed to a fine model, with a view to rapid speed and economy in fuel. The machinery, consisting of engines with cylinders 26 in., 42 in., and 72 in., by 48 in. stroke, three large steel boilers, 14 ft. 4½ in. by 11 ft., 180 lb. working pressure, will be supplied by The North-Eastern Marine Engineering Company, Ltd. The steamer will carry about 7,000 tons loaded, and steam at about 10 knots. The christening ceremony was performed by Miss Bahnsen, and amongst those present were Mr. P. Bahnsen and Mr. J. V. Smith, representing the owner; Mr. Rowland Hodge, managing director of the Northumberland Shipbuilding Company, Ltd.; and Mr. J. Graham, manager.

On the 16th inst. the large twin-screw steam yacht *Honor*, recently launched from the yard of Messrs. Ramage and Ferguson, Ltd., Leith, ran her trials on the Firth of Forth. The engines worked faultlessly, and a speed in excess of the guarantee was obtained. A feature of the trial was the almost entire absence of vibration. Mr. Barnett, of Messrs. G. L. Watson and Co., who are the architects, represented the owner on the occasion. The yacht has been built to the order of the Baron de Forest.

From their Wallsend shipyard, Messrs. Swan, Hunter and Wigham Richardson, Ltd., have just launched for a Hamburg firm, the steel screw steamer *Santa Cruz*. The vessel is of the following leading dimensions: Length overall 405 ft., beam 50 ft. 3 in., depth moulded 31 ft., and has been specially designed for the owners, trade to South America. The engines are being supplied by the Wallsend Slipway and Engineering Company, Ltd., and consist of a set of triple-expansion engines, having cylinders 25½ in., 43 in., 74 in. diameter, by 48 in. stroke, steam being supplied by three large single-ended boilers, working at 200 lb. pressure, and fitted with Howden's system of forced draught.

The sand pump dredger *Cetus*, recently launched by Messrs. Wm. Simons and Co., Ltd., Renfrew, and built to the order of the Natal Government, has just completed her official steaming and dredging trials on the Clyde. The sand pumping machinery was subjected to very exhaustive trials at Brodick Bay, when the vessel's hopper, which has a capacity of 3,000 tons, was loaded with sand well within the contract time. On completion of the pumping trials the dredger proceeded to Skelmorlie, where four runs were made on the Admiralty measured distance, when a mean speed of 10·3 knots per hour was easily obtained; which is considerably in excess of the specified speed. Mr. H. G. Humby, consulting engineer to the Natal Government, represented the owners at the trials.

The new steel-screw steamer *Leafield*, built by Messrs. Wood, Skinner and Co., Ltd., of Bill-Quay-on-Tyne, to the order of Alfred Brewis, of Newcastle, recently left the Tyne for her official trial trip, which proved entirely satisfactory. The propelling machinery, which has been constructed at the Northumberland Engine Works of the North-Eastern Marine Engineering Company, Ltd., Wallsend, consists of a set of their latest type of triple-expansion engines, having cylinders 23 in., 37½ in., 61½ in., with a stroke of 39 in., steam being supplied by two large steel boilers working at a pressure of 180 lb. per square inch.

Amongst those present at the trial were Mr. Brewis, Senr., Mr. Alfred Brewis, the managing owner, Mr. W. Burnett, Mr. Beckingham, Mr. Swan and Mr. Norman Burnett, under whose supervision the hull and machinery have been constructed, Mr. Skinner, Senr., and Mr. Leslie Skinner representing the shipbuilders, and Mr. D. Myles representing the engine builders.

The steel-screw steamer *Rheinfels*, which is being constructed by Swan, Hunter and Wigham Richardson, Ltd., for a Bremen firm, was launched from the Neptune Shipyard on Monday, the 19th inst. The steamer is over 420 ft. in length by 55¼ ft. beam, and will carry over 3,000 tons deadweight of cargo. She is to be fitted with quadruple-expansion engines on the Yarrow, Schlick and Tweedy system which, together with the boilers, are being constructed by Swan, Hunter, and Wigham Richardson, Ltd.

The s.s. *Puruni*, which has been built by Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne, for Messrs. Sprostons, Ltd., of Demerara, for their river passenger and cargo service, was taken out to sea on Friday for her trial trip. The dimensions of the vessel are: length over all, 147 ft.; beam extreme, 24 ft. 7 in.; depth moulded, 9 ft. She has been built to take Lloyd's A1 class for river and coast service in Guiana. The machinery has been constructed by A. G. Mumford, Ltd., of Colchester, and consists of two sets of triple-expansion engines, having cylinders 9½ in., 15 in. and 25 in. by 18 in., steam being supplied by a large single-ended boiler working at 180 lb. pressure. The vessel and her machinery have been constructed under the superintendence of the firm of F. J. Trewent (Mr. F. J. Trewent and Mr. W. E. Proctor), of London. On the trial trip a mean speed of about 10½ knots was attained.

On Friday the steel screw steamer ***Aeon***, built by the Northumberland Company Ltd., of Howdon-on-Tyne, for Messrs. Howard Smith Company Ltd., of Melbourne, left the Tyne for her trial trip. The steamer is 372 ft. long by 48 ft., beam by 30 ft. 10 in., depth moulded, and has been built under special survey to the highest class at Lloyd's Spar Deck Rule with extra strengthening for special freeboard. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery has been supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in. and 69 in. by 48 in., three large steel boilers 14 ft. by 10 ft. 9 in., 180 lb. pressure. During the trial the engines worked smoothly and satisfactorily, a mean speed of 11½ knots being easily attained.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Brighton.—For supply, erection, and maintenance for twelve months of a coal-handling equipment at their power station, Southwick, near Brighton, for the Town Council. Mr. Hugo Talbot, Town Clerk, Town Hall, Brighton ... . July 3

Hornsey.—The Council invite tenders for wiring and other work in connection with the electric light installation at the Council's Crouch End schools. Mr. Norman Staniland, Electricity Works, Tottenham Lane, Hornsey, N. ... ... July 3

Hull.—Construction of wells, adits, and bores at their Cottingham pumping station, for the Corporation. Copies of specification and form of tender may be obtained on payment of £2, which will be returned on receipt of a bona fide tender. Mr. F. J. Bancroft, water and gas engineer, Alfred Gelder Street, Hull ... July 6

Burton-upon-Trent.—The Corporation invite tender for the electrical equipment on the overhead system of about 1¾ miles of tramway. Plans and specifications may be inspected (after 26th inst.) at the offices of the consulting engineers (Messrs. Kincaid, Waller, Manville and Dawson), 29, Great George Street, Westminster, S.W., or at the office of the tramway engineer (Mr. P. J. Pringle), Guild Street, Burton-on-Trent ... ... July 7

Newport (Mon.).—The Electricity Committee invite tenders for the manufacture and delivery (but without erection) of cast-iron exhaust and water piping and welded flange lap-welded steel steam piping; one steel water-cooling tower, including erection; and one electrically driven surface condenser, including erection. Particulars from the borough electrical engineer and tramways manager (Mr. H. Collings Bishop) ... ... July 8

Brigg (Lincs.).—Supplying, erecting, setting to work, and maintaining two sets of pumping engines and boilers, each capable of raising one hundred gallons per minute, for the Brumby and Frodingham Urban District Council. Mr. Alfred Atkinson, C.E., Brigg ... ... July 10

London.—The London County Council invite tenders for supply, delivery, and erection at the Battersea and Wandsworth electricity sub-stations of two low-tension feeder switchboards. Specifications, etc., at the County Hall, Spring Gardens, S.W. The Council also invite tenders for supply, delivery and erection of four sets of high-tension feeder and low-tension machine switchgear for their tramway sub-stations at Battersea, Clapham, Streatham, and Wandsworth ... ... July 11

Last Day.

Leicester.—Supply and delivery of pipes and specials required in connection with Section No. 1 of the main for bringing the Derwent supply to Leicester, and for the Blackbrook temporary supply, comprising: straight socket pipes, 32¾ in., 339 tons 1 qr. 14 lb.; 32½ in., 2,573 tons, 7 cwt. 2 qr.; 32¼ in., 633 tons 12 cwt.; 15 in., 82 tons 7 cwt.; 12 in., 210 tons 19 cwt. 3 qr. 7 lb.; 6 in., 9 tons 7 cwt. 2 qr.; also of special castings 163 tons 17 cwt. 2 qr. 16 lb., for the Water Committee of the Leicester Corporation. Mr. J. B. Everard, M.I.C.E., 6, Millstone Lane, Leicester. ... July 12

Fulham.—The Council invite tenders for supply and construction of cables, feeders, etc. Specifications, etc., from the borough electrical and consulting engineer (Mr. Arthur J. Fuller) ... ... July 12

Earby, Skipton.—Construction of sewage tanks, bacterial filters, storm-water filter, engine-house, and other works for the extension of the Earby sewage disposal works, for the Skipton Rural District Council. Mr. H. A. Johnson, M.I.C.E., 15, Exchange, Bradford ... ... July 14

COMING CONTRACTS.

Bromley.—The District Council are raising £7,400 for the Farnborough drainage scheme.

Cuckfield.—Application has been made for a loan of £2,575 for extension of mains and for additional pumping machinery at the Balcombe waterworks.

Norwich.—The Sewerage and Irrigation Committee have recommended the adoption of a sewage scheme to cost £54,000.

Berwick-on-Tweed.—The directors of the North British Railway Company have authorised the erection of a new station at Berwick. The total cost is expected to exceed £50,000.

South Shields.—An inquiry has been held into an application of the Corporation for sanction to borrow £15,625 for extensions at the electricity works at Holborn to meet the requirements of the electric tramway service.

Shrewsbury.—At a meeting of the Town Council a new river scheme of water supply to the town was presented by the Water Committee. The scheme has been prepared by Mr. G. R. Strachan, London, and includes storage reservoirs, filters, and pumping station. The cost is estimated at £70,000.

Islington (London).—The Council has adopted the report of Professor Kennedy on the proposed extensions at the electricity works, and it was decided to obtain tenders for plant, estimated to cost £15,500.

Dublin.—An inquiry has been held into the application of the Corporation for permission to borrow £7,700 in connection with the scheme for the utilisation of the tramways system for the conveyance of the city refuse. The Lighting Committee will submit a report recommending application for sanction to a further loan of £100,000 for electric lighting extensions.

CONTRACTS CLOSED.

Alloa.—Messrs. Mackay Brothers, Alloa, have received, an order for a 600 ton D.W. steamer for English owners.

London.—The Brush Electrical Engineering Company Ltd., have received the following orders: Falkirk Tramways (per Bruce, Peebles and Co.); three double-deck car-bodies, mounted on Brush standard AA. type trucks. Yorkshire (Woollen District) Tramways; six single deck car-bodies mounted on four-wheel trucks with Brush 1002B motor equipments; four single-deck car-bodies, mounted on radial trucks with Brush 1002B motor equipments. Cavehill and Whitewell Tramways (per J. G. White and Co.); ten tramcars complete with Brush motor equipments.

Birmingham.—We understand that the contract for supplying steel rails and fish-plates to the tramway department of the City of Birmingham has been divided between Bolckow, Vaughan, and Company, Ltd., of the Cleveland Steel Works, Middlesbrough, who have received an order for 1,650 tons of rails and fish-plates, at £5 10s. per ton, and Hadfield's Steel Foundry Company, Ltd., of Sheffield, who are to supply a considerable quantity of special type tram rails.

Darlington.—An order for 22 large compound passenger engines and tenders for the Buenos Ayres and Rosario Railway Company has been received by Robert Stephenson and Company, Ltd., Darlington. The engines are to be of the six-wheel coupled type, with leading-bogie and double-bogie tenders. The company have also booked orders for the Argentine Transandine Railway Company for three-tank locomotives, and from the Indian State Railways for a number of duplicate boilers.

Milan.—The Kennicott Water-Softener Company are in receipt of an order from the Societá Generale Italiana Edison di Elletricita, of Milan, for a water-softener capable of dealing with 40,000 gallons per hour.

Kilmarnock.—Amongst the orders recently received by Andrew Barclay, Sons, and Co., Ltd., of Kilmarnock, are a 16-in. locomotive for the Cargo Fleet Iron Company, a 20-in. winding-engine for Young's Oil Company, Glasgow, and a motor-driven Capell fan to deliver 100,000 cubic feet of air at 3-in. water-gauge. An Oddie-Barclay pump is also being supplied to the same firm. It will be capable of delivering 600 gallons per minute against a head of 400 ft.

Belfast.—The Tramways and Electricity Committee have accepted the tenders of the British Westinghouse Company for three-phase plant for Fortwilliam Park sub-station of the Cavehill and Whitewell tramway, and that of the British Thomson-Houston Company for tramway switchboards.

Radcliffe.—The Radcliffe Council have accepted the tender of Mather and Platt for a 250 kw. steam dynamo (Browett engine) at £1,369.

Johannesburg.—Dick, Kerr, and Co. have secured the contract for the equipment of 30 miles of tramway on the overhead system for Johannesburg Corporation.

Ireland.—Among the orders recently secured by Johnson and Phillips is the supply of a 350-kw. three-phase alternator, 96 revs. per min., for supplying power in a large works in the Midlands, a 35-kw. combined set direct current for power in a manufactory in Ireland, and 200-kw. three-phase alternators, 120 revs. per min., for a colliery installation.

Kirkcaldy.—The Stirling Boiler Company have received an order from the Kirkcaldy Tramways and Electric Light Station for two Stirling Boilers fitted with chain grate stokers, each to evaporate 18,500 lbs. of water per hour.

Hastings.—The Council have accepted the tender of the Electric Construction Company for four 40 kw. transformers.

APPOINTMENTS VACANT.

Leyton. — Traffic Superintendent and Manager of Tramways about to be required by the Council. Salary at the rate of £300 per annum. Mr. N. Vincent, Clerk, Town Hall, Leyton ... ... July 1

London.—Temporary draughtsman under the Metropolitan Asylums Board. Salary £125. Apply Mr. T. Duncombe Mann, Clerk, at offices, Thames Embankment, E.C. ... ... July 3

Durban.—Boiler Superintendent in the Corporation Electric Power Station. Salary £250 to £300 per annum. Messrs. Webster, Street, and Co., agents, 5, East India Avenue, E.C. ... ... July 4

Blackburn.—Blackburn Education Committee require an assistant lecturer in pure physics. Salary £120 to £140. ... July 11

London.—The London County Council invite applicacations for the position of principal of Paddington Technical Institute. Commencing salary £500 ... ... —

APPOINTMENTS FILLED.

Buenos Ayres.—Mr. F. W. Courtenay Clarke, assistant general manager and accountant of La Capital Tramways Co., Buenos Ayres, has been appointed assistant general manager of the Grand National and New Companies, retaining his position with La Capital Co. Mr. H. C. Bocquet, general manager of La Capital Tramway Co., has been appointed to manage the Grand National and New Tramway Companies, in place of Mr. Wall, resigned.

Glasgow.—Mr. G. Moncur, B.Sc., A.M.Inst.C.E., has been appointed to the Lectureship in Civil Engineering at the Glasgow and West of Scotland Technical College. Mr Moncur was a graduate of Edinburgh University, and since 1900 has occupied the post of chief assistant engineer on the Great North of Scotland Railway.

Newcastle.—Mr. James Hall, Wh. Ex., A.M.I.E.E., of Manchester, has been appointed demonstrator in mechanical engineering at Armstrong College, Newcastle-upon-Tyne.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

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STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: July 5th, Aug. 3. General Settlements: July 13th and 28th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅝—2⅞
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4¼—4¾
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 3/16—3 5/16
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜—5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	104—106
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96—99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord. ..	1	5¼—5½
100,000	1	7½d.	Do. 6% Cum. Pref.	1	1 7/16—1 9/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾—5¼
250,000	1	6⅜d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1—1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	103—105
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1 3/16—1 5/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛—4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾—5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104—106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12—12½
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16—½
300,000	1	6⅜d.	Do. 5½% Cum Pref.	1	11/16—13/16
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96—99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	31/32—1 1/32
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	½—9/16
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16—1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1½—1¾
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11⅛—11⅜
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8⅜—8⅝
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5 3/16—5 5/16
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	15/16—1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅜—5⅝
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	101—103
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	31—32
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15⅞—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛—2⅜
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	9/16—⅝
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	89—93
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	2¾—3¼
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	½—⅝
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	⅞—1
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½—10½
69,754	13	12/-	Do. do. do.	10	7⅜—7⅝
20,250	10	8/-	Elliott's Metal, Ltd.	8	4¾—5¼
5,000	10	5%	Do. Cum. Pref. 5%	10	9½—9¾
186,748	Stk	4%	Do. Deb. 4%	100	93—95
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11—12
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100—103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000..	10	12¼—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	5	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4⅜—4⅝
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾—6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6—7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	90½—91½
16.800	10	—	Greenwood & Batley, Ltd., Ord. ..	10	5¼—5½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¼—10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 3/16—2 5/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅜—6⅝
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105—107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2—3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3½—3⅝
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾—11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5—5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 3/16—1 5/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	99—101
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5—5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16—13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾—5
£100,000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100*

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1⅝—1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	13—13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	97—100
37,500	10	20	Kynoch, Ltd.	10	18½—19
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅞—11⅛
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝—⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4—4½
40,000	3	2/1½	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾—4
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16—1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	109—111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11½—12
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	⅝—¾
75,000	1	6⅜d.	Do. 5½% Cum. Pref.	1	13/16—15/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92—95
21,943	5	2/6	Muntz Metal, Ltd.	5	4⅞—5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅞—5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79—81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	90—93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3¾—4
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6¼—6¾
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9½—10
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97—100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	5—5¼
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/-—6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	3⅞—4⅛
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜—½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝—1⅞
73,062	5	2/-	Do. New	5	1½—1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	102—104
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	25/32—27/32
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	95—97
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9½—10
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	11/16—13/16
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	⅞—1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94—96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	93—96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	94—98
250.000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	11/16—13/16
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	⅞—1
£300.000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	91—94
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5⅜—5¾
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb. ..	100	106½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2—2¼
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4—4¼
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	77—80
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17¾—18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½—15
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾—⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞—1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red	100	98—101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½—⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	76—80
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	⅝—⅞
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	15/16—1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½—10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	32⅜—32⅞
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	102¼—102¾
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	97—99
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord..	1	2 7/16—2 9/16
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1⅛—1¼
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	118—121
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	105—107
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	105—107
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16—15/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	⅞—1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	83—87
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½—4¾
[illegible]	Stk	4½%	Do. Mort. Deb. 4½%	100	92—98
66,666	5	3/.	Willans & Robinson, Ord.	5	1—2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2½—3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73—78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	76—78

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16— 9/16
120,000	1	1/2⅝	Bell's Asbestos Co., Ltd.	1	⅞— 1
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 —106
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100—102
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2 7/16—2 11/16
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	89 — 91
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4⅜	Do. 6% Pref.	2	1 — 1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10 — 11
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5⅜— 5⅝*
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	106 —108*
85,000	3	1/6	Crompton & Co., Ltd...	3	1⅞— 2⅛
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95—100%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7½— 8
61,000	5	8/-	Do. 6% Cum. Pref.	5	5¾— 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	106 —108
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% free. Deb. Stk.	100	107 —110
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1¼— 1½
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	84 — 89
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89 — 94
112,100	2	1/7½	Electric Construction Co., Ltd. .	2	¾— 1
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	2¼— 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	95 — 98
10,248	10	7/6	Evered and Co., Ltd...	10	11 — 13
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9⅞— 10⅛
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5½— 5¾
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½—16½*
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	32 — 34
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜— 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	6 — 6¼
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143*
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	12½—13½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9¾ -- 10¼
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	¾— ⅞
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16—1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord...	5	1¼— 1¾
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	105 —108
		5%	Pref. Ord. Stock	100	98 —101
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9½— 9¾
156,437	10	6/-	Do. 6% Cum. Pref... ..	10	11¼— 11¾
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122— 124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3 — 3¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½— 5¾
27,000	5	3/-	Do. "B" do.	5	5¼— 5½

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	98 — 100
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 —105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8 3/16— 8 7/16
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 —109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1¼— 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —103
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½— 14½
59,987	10	6/-	Do. 6% Pref...	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¾— 3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	85 — 90
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9¾—10¼
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—103
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	9/32— 11/32
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	106 —108
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2⅞	North Metropolitan Tramways Co..	8	4½— 5
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾— 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¼ 9¾
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾— 12
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11½ — 12½
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	107 —109
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼— 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9¾— 10¼
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9½ - 10½
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103 —106
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	7½— 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½— 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107*
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6⅛— 6⅝
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10¾— 11¼
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¾— 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	124 —128
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	104 —106
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8¼— 8¾
30,000	10	6/-	Do. 6% Cum. Pref.	10	12⅛—12⅝
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	113 —116
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾ — 6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6½
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 —109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½— 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾— 8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾— ⅞
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	11½— 12½

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	3	1/9⅔	London Elec. Supply Corp., Ld., Ord.	3	2 — 2⅛
60,000	5	8/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 –101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9¾—10¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5½ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	111 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	99 —101
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution. Ld., 4½% 1st Mort. Deb.	100	101—103%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14¼—15¼
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½— 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99½—101½
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref.	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	99 —101
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3¾— 4¼
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	¾— ⅞
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1¼ — 1⅜
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4¾ — 5
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12 —13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼ — 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	100—103
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	15/-	Anglo-American Tel. Co., Ltd., Ord.	100	59 — 61
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	105 —106
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	14⅞—15⅛
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6¾ — 7
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97½— 99½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8 — 8½
6,000	10	10/-	Do. 10% Preference	10	16½—17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	9 — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	102-104%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11⅛—11⅜
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	101—103
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100½—102½
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100½102½%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14 — 14½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	141 —144
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90 — 92
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	33 — 34
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	101—103
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	49 — 51
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	¾— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	111—112
£1,966 667	Stk	5%	Do. Deferred	100	102—104
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5½ — 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	8⅔d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅛ — 1¼
50,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1 1/16—1 3/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½— 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	108—110
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	8½ — 9*
£30,008	2½	—	West Coast of America, Ltd. ..	2½	7/16 — 9/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 —102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½ — ⅝
84,568	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8— 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	5¾— 6¼
£80,000	100	5%	Do. 5% Deb.	100	104 —106
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ — 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	102 —104
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99—101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	97 — 99
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	101 —103
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12 — 12½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	100—102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 3/16—1 5/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	88 — 90
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	129 —132
£1,160,000	Stk	19%	Do. do. Deferred ..	100	223 —226
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	30 — 31
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8½
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	103 —105

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 1/16—1 3/16
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	127 —132
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜ — ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ — 1¼
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1⅛ — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

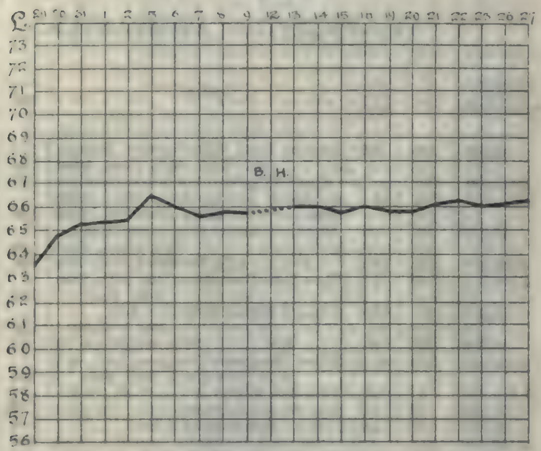
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22½—23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¼— 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾—14¼
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9⅛— 9⅜
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4¼— 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2⅜ — 2⅝
4,150	10	5%	Do. do.	10	10½—10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	42/3--42/9*
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6--24/6*
235,000	1	7⅕d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6-- 28/6*
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

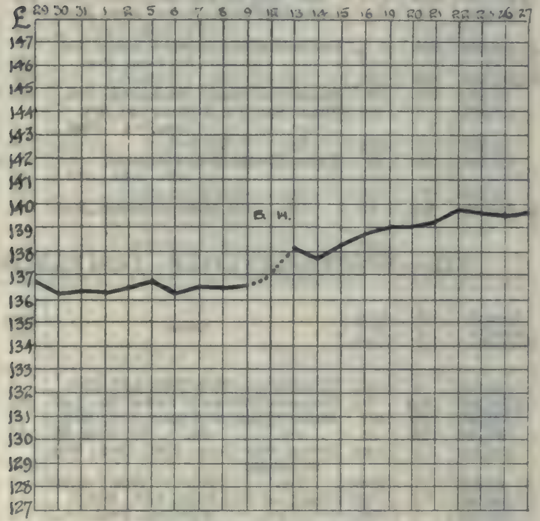
THE HOME METAL MARKET

SHOWING DAILY FLUCTUATIONS FROM MAY 29TH TO JUNE 27TH, 1905.

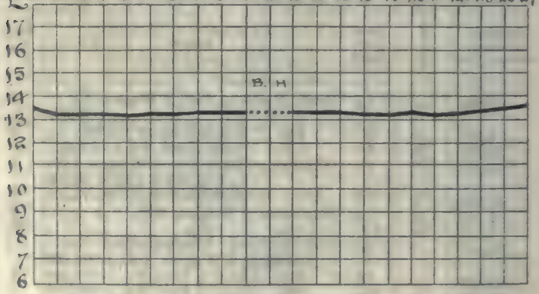
COPPER.



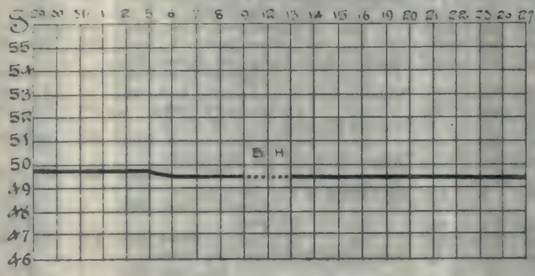
TIN.



ENGLISH LEAD.



PIG IRON: SCOTCH,



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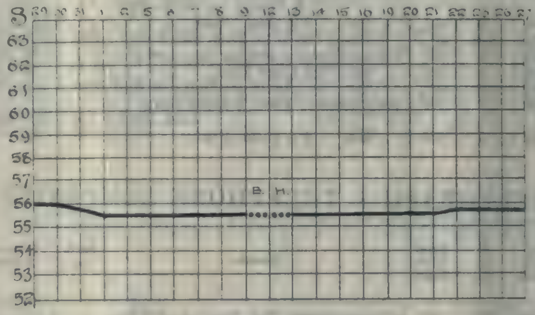
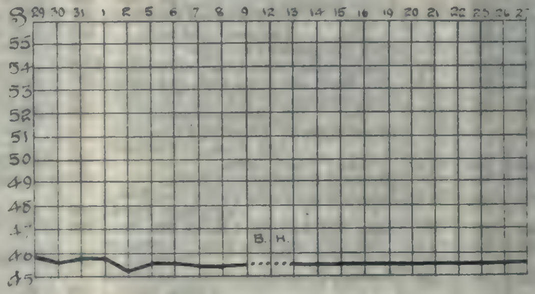
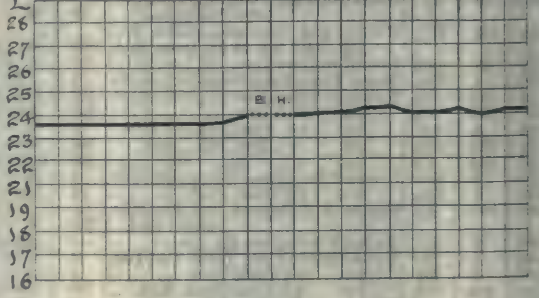


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, June 21st, 1905.

THE aspect of the Copper market is full of suggestiveness, in spite of the fact that speculation is smaller than for some time past and that trade demand has reached a condition bordering almost on stagnation. There is, however, an undercurrent of strength which points to an early revival of activity, and it is noteworthy that the bears, having analysed the position, deem the moment an opportune one to make repurchases, although these at present are only on a small scale. The closing price yesterday was cash £66 1s. 3d., three months £66.

The improvement in the Tin market has made further progress, and a brisk demand is to be noted, not only for near dates, but for forward delivery. A satisfactory feature is that the market is almost entirely free from manipulation, the activity on 'Change being the result of good demand on the behalf of consumers. There is, however, fear that the rise may be pushed too far, and but for the fact that the conditions are so intrinsically strong the persistent rise in values might easily give rise to some uneasiness. Cash and near dates are now quoted £139 12s. 6d., and three months £138 7s. 6d.

Lead is firmer, and if business has not been particularly brisk, sellers have pursued a holding-off policy, with the result that consumers have had to pay the prices asked. The consumption of the metal at the moment is particularly good, more particularly as Messrs. Merton and Co.'s circular points out for electrical purposes, and the market closes firm at £13 3s. 9d., for soft foreign prompt, with English at £13 8s. 9d.

Spelter has been an active market and on some bear covering for June delivery there was a rise to £24 5s., at which price a good many orders came on the market. The market remains steady, but sellers now predominate, and the price has gone back to £24, with specials at £24 7s. 6d.

The healthy position of the iron and steel industries in Europe has been reflected in a better tone in the market, but speculative transactions, though showing some increase in volume, are still rather artificial in character. Closing London prices are Cleveland 45s. 6d. and Standard 44s. 6d.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles..........	5	7	6

Manufactured Iron:

		£	s.	d.
Bars—Dalzell	....	6	2	6
,,	Best	6	12	6
,,	,, Horseshoe	6	12	6
,,	Angle..	6	2	6
,,	Best Angle	6	12	6
,,	Best Best	7	2	6
,,	Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	7	6	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	7	6	,,
Glasgow ♛♛ Steel.				
Steel Bars, Boiler Quality	6	17	6	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

		£	s.	d.
Bars—Phœnix	....	6	5	0
,,	Best	6	15	0
,,	Best Best	7	5	0
,,	Extra Best....................................	7	15	0
,,	Best Horse Shoe	6	15	0
,,	Extra B.H.S.	7	15	0
,,	Extra Best Cable	8	5	0
,,	Rivet	6	5	0
,,	Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	3	0	2	13	0
Gartsherrie ,,	2	17	0	2	13	0
Summerlee ,,	2	17	6	2	13	6
Carnbroe ,,	2	14	6	2	13	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	18	0	—		
Clyde ,,	2	16	6	2	12	6
Glengarnock, f.o.b. Ardrossan	2	17	0	2	12	6
Eglinton ,, ,,	2	12	6	2	10	6
Dalmellington, ,, Ayr	—			2	12	0
Shotts ,, Leith	2	17	6	2	12	0

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♛ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♛	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♛ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d
♛ (BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♛ W.I.W.	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 86in. per ton.			Doubles 21 G to 24 G 96in. by 86in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	0	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt.
} d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt.
} d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	12	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	0
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	9
C 28 by 20 112s. 216 ,, "Lydbrook"	1	3	9

Charcoal Tinplates:

	£	s.	d.
C 20 by 14 112s. 108 lb. "Allaway"	0	12	6

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d	
Blooms	at	3	16	0	per ton.
Billets	at	3	18	0	,,
Sheet Bars	at	4	0	0	,,

Finished Steel:		£	s.	d.	
Bars	at	5	0	0	per ton.
Angles	at	5	1	0	,,
Tees	at	5	4	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	5	0	,,
Tyre Bars	at	5	5	0	,,
Half-Round Bars	at	5	10	0	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1½% & 1%	140	0	0	to	140	10	0	per ton.
English Bars, f.o.b. Dis. 1½% & 1%	141	0	0	to	141	10	0	,,
Straits G.M.B., cash Warehouse, Net	139	15	0	to	140	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	138	7	6	to	138	10	0	,,
Australian, Mt. Bischoff, Warehouse, Net	141	10	0	to	142	0	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	66	3	9	to	66	5	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	66	2	6	to	66	3	9	,,
English, Tough, Cake & Ingot, Warehouses, Net	69	10	0	to	70	0	0	,,
English, Best Select, Warehouse Net	70	10	0	to	71	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	79	0	0	to	80	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	75	0	0	to	76	0	0	,,
Electro, Warehouse, Net	69	5	0	to	69	10	0	,,
Ore, ex. ship	0	11	9	to	0	12	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	0	to	0	13	6	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6⅝	per lb.
Sheathing ,, ,,	0	0	6½	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	0	0	to	24	5	0	per ton.
Blende of 50 % Net	6	12	6	to	6	13	6	,,
Calamine, Net	6	15	0	to	6	16	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	13	5	0	to	13	7	6	per ton.
Spanish, ex ship, Dis. 2½%	13	2	6	to	13	5	0	,,
Lead Ore of 70 %, Net	6	14	6			—		

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	49	0	0	to	50	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	0	0	to	16	10	0	,,
Crude, ex ship, Dis. 2½ %	29	0	0	to	30	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask
Italian ,, ,, ,,	7	5	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, uote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per on for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston uote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	15	0	per ton.
Grey ,, –	12	0	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	11	3	,,
Arsenic: Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax: British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:				
Benzole, 50/90 % ,,	0	0	6	per gal.
,, 90% ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6¼	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	6½	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½ % at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ,,	0	0	1½	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	8	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	19	10	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	0	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	15	0	,,
Nitrate	24	10	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	6	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England...	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull ...	18	5	0	per ton.
Caustic, 75/80 % ,, ,, ...	20	10	0	,,
Chlorate net	0	0	3$\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	33	0	0	per ton.
Prussiate, Yellow net	0	0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined...... ,,	6	5	0	,,
	,, Carbonated, 48 %............ ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 %................ ,,	10	10	0	,,
	,, ,, 70 %................ ,,	9	12	6	,,
	,, ,, 60 %................ ,,	8	12	6	,,
	,, Cream, 60 %..... .... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ....c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
	Bichromate......delivered England...	0	0	$2\frac{1}{4}$	per lb.
	Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
	Nitrate...ex quay Liverpool, ... ,,	11	2	6	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	$3\frac{5}{8}$	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)................	1	12	6	,,
	,, (Saltcake, 95%)................	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers..............................	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac;	Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports...........	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool $10\frac{1}{4}$d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	11	9	to	0	12	9	per unit.
Regulus, 45 to 55%	0	13	0	to	0	13	6	,,
Precipitate, 65 to 80%	0	13	$1\frac{1}{2}$	to	0	13	$7\frac{1}{2}$	,,
Tin Ores, 70 %...............	86	0	0	to	88	0	0	per ton.
Lead Ore, 70%					6	14	6	,,
Blende, 50%					6	13	6	,,
Calamine.......................					6	16	0	,,
Antimony Ore, 50%......	14	0	0	to	17	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman................	6	8	per ton.
Do.	,,	Cartagena............	6	6	,,
Special low phos.	,,	Porman	6	10	,,
Do. do.	,,	Cartagena............	7	0	,,
Extra quality do.	,,	,, ...	7	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	,, ...	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine................	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce..	,,	7	0	0		7	10	0
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime..................	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

12204. W. Horsfall, Leeds. June 13th.—Improvements in or relating to means or apparatus for imparting and transmitting motion to machinery.

12207. J. H. Dales, Elstree. June 13th.—An improved form of bolt head and washer and nut and washer for fastening taper and other flanges, chiefly with reference to rolled steel construction.

12219. J. Barr, Glasgow. June 13th.—Improvements in or connected with sluice valves.

12222. H. H. Mulliner and A. F. Patch, London. June 13th. — Improvements in submarine and submersible boats.

12231. R. E. Barnett, Leeds. June 13th.—An improved tool for boring or internal turning for use with lathes or similar machine tools.

12258. M. Matthews, London. June 13th.—Improvement in fluid turbines.

12299. T. D. Prescott, J. C. Prescott, and H. A. Prescott, London. June 13th.—Improvements in turbines.

12300. F. Forster, London. June 13th.—Improvements in or relating to crucible furnaces.

12304. E. Jolicard, London. June 13th.—Improvements in water tube steam generators.

12305. W. Peck, London. June 13th.—Improvements in propellers for ships and like vessels.

12327. A. Boyd, Stockton-on-Tees. June 14th. —An improvement in high speed engines.

12335. D. Marshall, Cheltenham. June 14th.—Improvements in and connected with means for locking nuts, bolts, studs, and the like.

12359. J. N. Russell, London. June 14th.—Improvements in the heating of water or other liquids by the condensation of steam.

12361. H. M. Russell, Jun., London. June 14th. —Improvements in mechanism for transmitting rotary motion.

12370. D. J. Crozier, London. June 14th.—Improvements in straight-way valves.

12374. H. H. Lake, London. June 14th.—Improvements in and relating to throttle valves. (*Aurora Automatic Machine Co., U.S.A.*)

12411. F. Hargreaves and J. G. Hudson, Glasgow. June 16th.—Improvements in steam traps.

12423. W. H. Watkinson, London. June 16th.—Improvements in steam superheaters for boilers of the locomotive type.

12443. C. D. Drury, London. June 16th.—Improvements in and relating to stop valves and the like.

12477. J. Westwood, C. Barter, and T. Taylor, Birmingham. June 16th.—An improved table for lacquering brass and other metal in combination with the method of heating same with high pressure hot water pipes or steam pipes.

12511. H. McPhail, London. June 16th.—Improvements relating to steam generators.

12515. The Vulcan Foundry, Ltd., and W. Collingwood, London. June 16th.—Steam tight bolt, nut, and washer for boiler stays and like purposes.

12517. C. H. Bryant and F. L. M. Forster, London. June 16th.—Improvements in pumps.

12519. F. J. H. Lascelles, London. June 16th.—Improvements in or relating to the automatic closing of throttle and other valves, particularly in connection with winding engines and the like, and with overwinding apparatus.

12521. C. K. Tollenaar, J. H. Proctor, and W. A. Wallace, London. June 16th.—Improvements relating to furnaces for steam generators.

12577. Maschinenfabrik Grevenbroick, Liverpool. June 17th.—Improvements in the rotating wheel blades in multi-tier steam or gas turbines. (Date applied for, July 8th, 1904.)

12578. F. Poletto, London. June 17th.—A compensation balance device for the distribution-valve mechanism of steam engines. (Date applied for, June 17th, 1904.)

12584. W. M. Wood, London. June 17th.—Improvements in the form of stern hulls of steam vessels and their propellors. (*I. S. A. Evseiev, Russia.*)

12600. P. L. T. Heroult, London. June 17th.—Improved method of, and apparatus for, affecting marine propulsion. (Date applied for, June 21st, 1904.)

12601. M. H. P. R. Sankey, London. June 17th.—Improvements in and relating to steam turbines.

12602. R. Allen, London. Improvements in or connected with draw-gear for traction engines, road locomotives, and the like.

12609. W. D. Tilden, London. Improvements in multiple discharge pumps.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN COOLING CRANK PINS AND SHAFTS.

Fried Krupp, Akt. Essen., Germany. Accepted May 11th, 1905.—This invention refers to cooling crank pins and shafts by causing a current of air to pass through a bore or passage formed through the crank pin, and this hood being revolved with the shaft and crank acts by suction or by pressure, according as its opening is turned in one direction or the other, to produce an air current through the said passage. The invention is shown on the drawings by two examples of construction applied to crank shafts whereon fig. 1 shows one construction in elevation, fig. 2 is a left hand transverse section on the lines 2——2 of fig. 1, and fig. 3 is an elevation showing a modified construction where two hoods are employed, one at each orifice of the bore through which air is to be forced. In figs. 1 and 2 the crank pin of the crank shaft is bored longitudinally or formed tubular or open at both ends; at one end about the orifice of the bore is fixed a cup-shaped hood, the opening of which is in the path of travel of the crank pin and the opening of the hood communicates with the bore of the crank pin. When such a hood is fixed on one side of the crank only, as in figs. 1 and 2, and the crank shaft is rotated in the direction indicated by arrow (fig. 2), air enters the open mouth of the hood and is forced by pressure through the bore of the crank pin; flowing through said bore in the direction indicated by arrow in fig. 1, and effecting a cooling of the crank pin. When the shaft in the construction shown at figs. 1 and 2 is rotated in the opposite direction the hood acts by suction, the current of air then flowing through the bore in the opposite direction to that indicated by the arrow in fig. 1. In the modification, a hood is arranged at each end of the crank pin, the openings of the two hoods being in opposite directions in relation to each other. With this construction when the crank shaft is rotated in one direction or the other, one hood always acts by suction and the other by pressure, so that a stronger current of air is produced through the bore of the crank pin than in the arrangement shown in fig. 1.

FIG. 1.

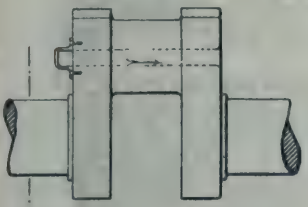


FIG. 2.

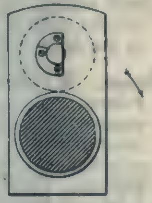
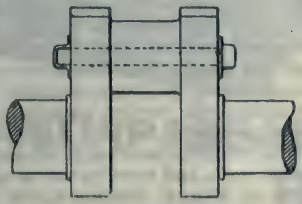
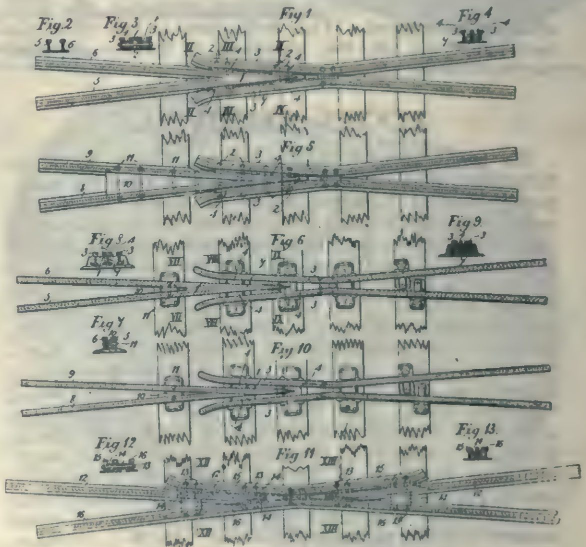


FIG. 3.



IMPROVED MANUFACTURE OF RAILWAY CROSSINGS, POINTS, AND GUARD RAILS.

R. A. Hadfield, of Sheffield. Accepted May 18th, 1905.—This invention has for its object to provide railway crossings, points, and guard rails that will be much more durable than those heretofore ordinarily employed, and for this purpose the crossings, points, and guard rails of general forms, such as those of the composite crossings and rolled points and guard rails, are made with rail-like sections and of manganese steel—preferably Hadfield's patent "Era" manganese steel—making use in their manufacture of the special heat treatment. In the accompanying drawings figs. 1 to 4 inclusive represent a composite crossing of ordinary form and agreeing in cross section with vignoles or flat bottom rails, fig. 1 being a plan and figs. 2, 3, and 4 being cross sections corresponding respectively to the lines II., III., and IV. of fig. 1. The V piece, which is secured by bolts between two wing rail portions with interposed distance pieces, is a single casting having two divergent portions of the cross section of ordinary railway rails as shown in fig. 2, the web of the two divergent portions branching off from a web portion of the point portion of the V piece (figs. 1 and 4). Fig. 5 is a plan of a composite crossing of ordinary form agreeing in cross section with vignoles or flat-bottom rails wherein the V piece is constructed of two rails which are formed taper where they join together so as to form the point of the V piece. Figs. 6 to 9 inclusive, and fig. 10 represent similarly to figs. 1 to 4 inclusive, and fig. 5 respectively, railway crossings of ordinary form agreeing in section with double or bull-headed rails; figs. 7, 8, and 9 being cross sections corresponding respectively to the lines VII., VIII., and IX. of fig. 6. Parts shown in figs. 6 to 10 inclusive, and corresponding to parts shown in figs. 1 to 5 inclusive, are indicated by corresponding numbers. Figs. 11, 12, and 13 represent a composite angle crossing agreeing in section with vignoles. In lieu of forming the V piece above described, it may, however, be constructed of two rails which are cast taper so that when put together or scarfed they will form a point. The rails forming the wing portions may be cast straight and subsequently bent to shape, and in the case of switches the tongues may be cast taper for their whole length or for part of their length. The tongues of switches may, in some cases, be formed by forging, or by rolling and then forging. The chairs of crossings, points, and guard rails, according to this invention, may be made of cast iron, cast steel, Hadfield's patent "Era" manganese steel, or in some cases of forged steel.



NEW PUBLICATIONS.

"ELEMENTARY STEAM ENGINEERING."

By H. W. Metcalfe, R.N. Longmans, Green and Co. 7s. 6d.

Engineer-Commander Metcalfe maintains that even the most elementary of existing engineering text-books presuppose some knowledge of the laws which govern the subject; the present work, however, is designed for the purpose of inculcating the rudimentary principles of engineering science into the minds of young pupils in order that they may be prepared for more advanced works. The writer's excellent experience at the Royal Naval College, Osborne, enables him to perfectly realise what constitutes the early difficulties which the student has to overcome. The work, which is one of exceptional lucidity, deals with naval engineering; the steam engine; expansive working of the steam engine; details of the mechanism; the condensing engine; the compound engine; the boiler; materials used in the construction of the steam engine and of machinery generally.

"DIGEST OF THE EVIDENCE GIVEN BEFORE THE ROYAL COMMISSION ON COAL SUPPLIES, 1901-1905."

Reprinted from the "Colliery Guardian," after revision by the witnesses. Volume I. The Chichester Press.

In preparing this digest the compiler's aim has been to render the evidence more readily accessible by the rearrangement and classification. It is proposed to complete the work in three volumes, the first of which is devoted to the working of thin seams; limit of depth in mining; waste in working, and coal-cutting by machinery. Our readers are already well acquainted with the value of the information elicited by this inquiry, and those who have a permanent interest in the question of coal supplies cannot do better than secure this valuable reprint, which in order to facilitate reference, has been admirably indexed. The dedication of the work has been accepted by the chairman of the Commission, the Right Hon. Lord Allerton.

BOOKS RECEIVED.

We have also received: "Wire Ropes used for Winding: their strength and some causes of its reduction." By J. A. Vaughan and W. M. Epton. (McKowen and Co., Johannesburg.) A reprint of an interesting paper read before the Transvaal Institute of Mechanical Engineers. "The Principles of Foreign Exchange as affecting the Preferential Trading with the Colonies." By Ewing Matheson. (E. and F. N. Spon.) The value of this pamphlet may be estimated from the fact that it is already in its fourth edition. "Fire Tests with Automatic Fire-Alarm Systems." Report of the British Fire Prevention Committee. (Published at the office, Waterloo Place, Pall Mall. 3s. 6d.) An illustrated account of the tests carried out on the Autopyrophone Company's automatic fire-alarm system.—"The Rudiments of Practical Mathematics." By A. Consterdine and A. Barnes. (John Murray. 2s. 6d.) A handy little volume which should be found useful to technical school students.—"The Compound Engine." By W. J. Tennant. (Percival Marshall and Co. 2s. 6d. net) A well-illustrated elementary treatise, written in a style that will be readily understood by the non-technical reader.—"The Calendar of the University of Toronto." (The University Press.) A rather elaborate production containing a number of photographs in addition to the general information for students.

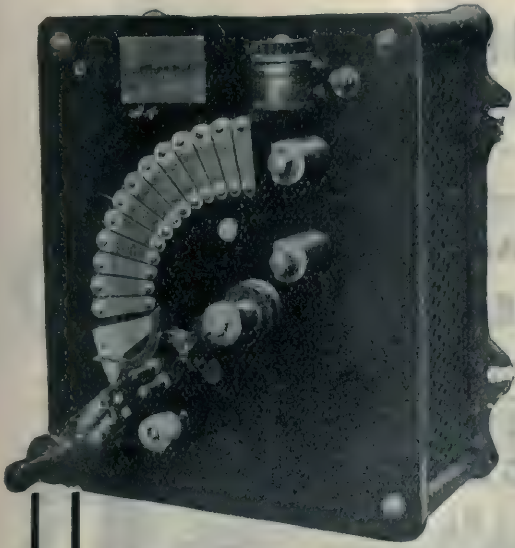
NEW CATALOGUES.

The Electrical Company, Ltd., of 121-125, Charing Cross road, W.C., forward a quantity of literature on their specialities, all of which is well and attractively produced. Leaflet No. 152 describes their lamp shades; pamphlet No. 158, electric fans and ventilators; leaflet No. 159, hour and time meters; No. 161, hand-drilling machines; No. 162, centrifugal blowers and extractors, and price list No. 16 double tariff meters and contact checks. Any of these will be forwarded on application to the firm.

Messrs. W. Summerscales and Sons. Ltd., Phœnix Foundry, Keighley. The amount of skill and inventive enterprise which has been expended upon laundry machinery is well illustrated in the comprehensive catalogue of 156 pages which has just been issued by this firm. Attention is particularly called to the firm's system of hot air drying and their "Challenge Renown" washing machines, which are claimed to be the cheapest "All-metal" washing machines on the market. These, we are informed, have been produced to meet the growing demand for a washing machine made entirely of metal at a price within the reach of all. A glance through these informing pages leads to the conviction that there is not much known in this particular field about which Messrs. Summerscales and Sons, Ltd., cannot give full and complete information. In order that the details of the numerous apparatus may be more readily available, an index has been included and among the earlier pages will be found general remarks on steam laundry appliances, useful information, hints *re* expert assistance, laundry management, telegraphic code, and some practical suggestions for the working of Messrs. Summerscales' machines. Applications for the catalogue should be marked "P.W."

W. and T. Avery, Ltd., Soho Foundry, Birmingham We have frequently described the testing machines made by Messrs. Avery, and in calling attention therefore to their catalogue No. 221, may content ourselves with a reference to the various headings under which the machines are described. These include Transverse Bar Testing Machine (capacity, 40 cwt.). Combined Testing Machine for Cast Iron for tensile and transverse tests (tensile capacity, 60 cwt., transverse capacity, 40 cwt.); Hydraulic Testing Machine for tensile, transverse, and compressive strains (capacities, 10 tons to 100 tons); Hydraulic Vertical Testing Machine (single lever type) for tensile, compressive and transverse tests (capacities, 50, 100 and 150 tons); Hydraulic Spring Testiug Machine for testing laminated springs (capacities, 10, 12, and 15 tons); Spring Testing Machine, for tensile and compressive tests (capacities, 20 and 40 cwt.); Hydraulic Machine for proving and testing wire and hemp ropes and cables (usual capacities, 5, 10, 15, and 20 tons); Chain Testing Machine (hand power, capacity, 5,000 lb.); Improved Testing Machine (hand power) for wire and small specimens (capacities, 5,000 and 7,000 lb.); Improved Testing Machine for wire, metal strips and small specimens (capacities, 10,000 and 20,000 lb.); Torsion Testing Machine (capacity, 10,000 inch lb.); Improved Cement Testing Machine (capacities, 1,000 and 2,000 lb); Hand-power Yarn Testing Machine (capacities, 100 to 500 lb.): Patent Impact Testing Machine; Wire Torsion Tester; and Hydraulic Chain Testing Machine, designed to conform to the Board of Trade Regulations (maximum testing capacity, 100 tons, maximum length of specimens 90 feet). The pamphlet opens with notes on experts' views, testing cast iron, and practical hints on cast-iron test bars.

PAGE'S WEEKLY Miscellaneous



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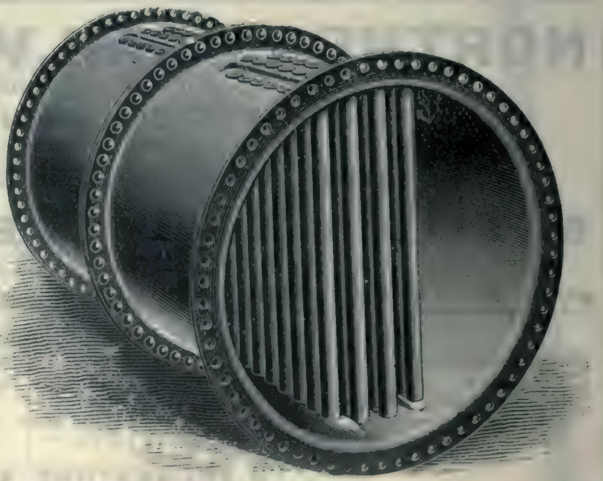

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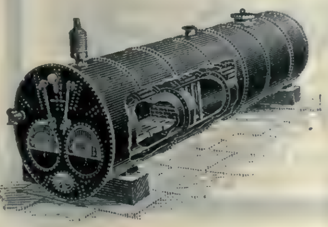

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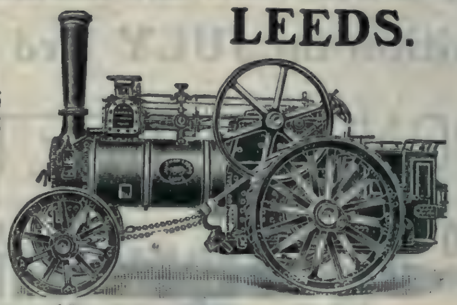

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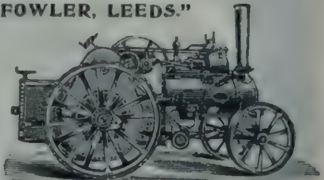

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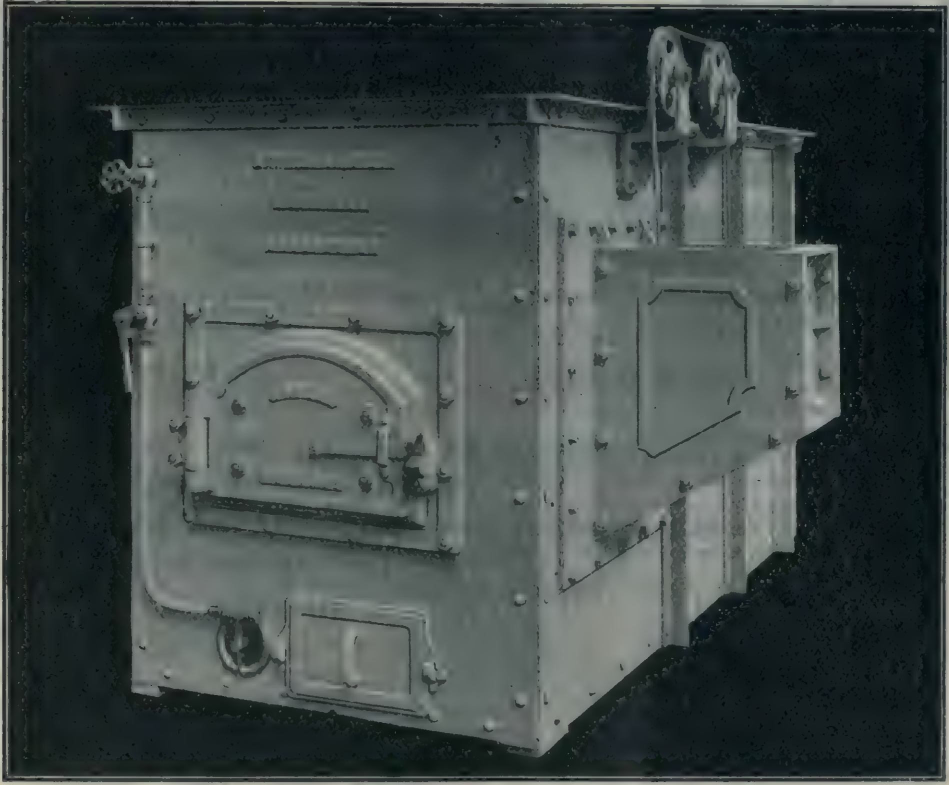

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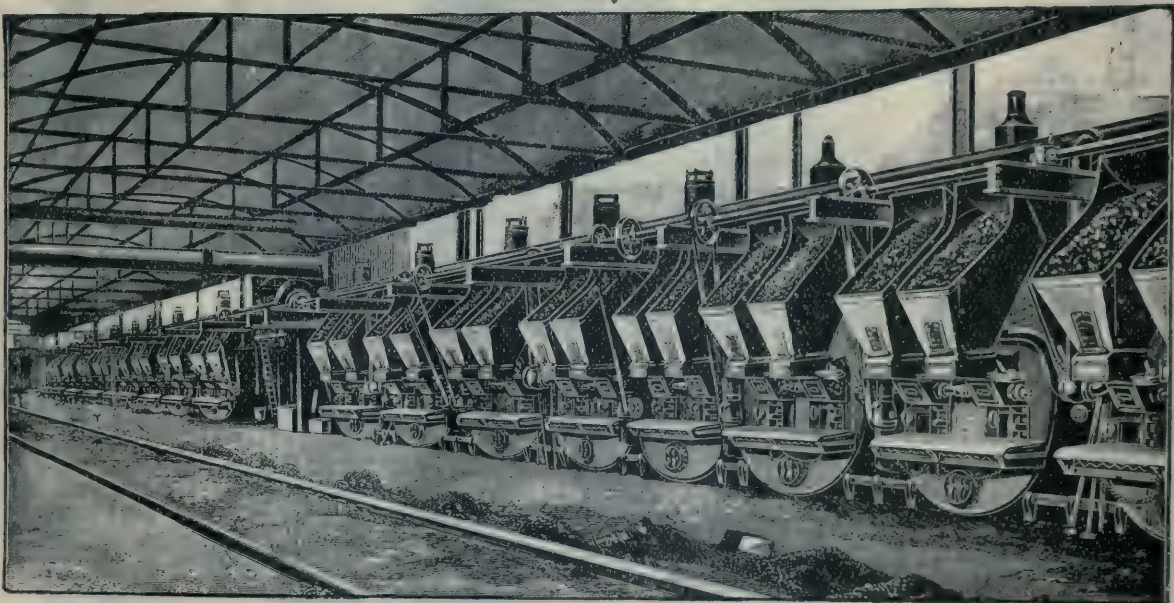

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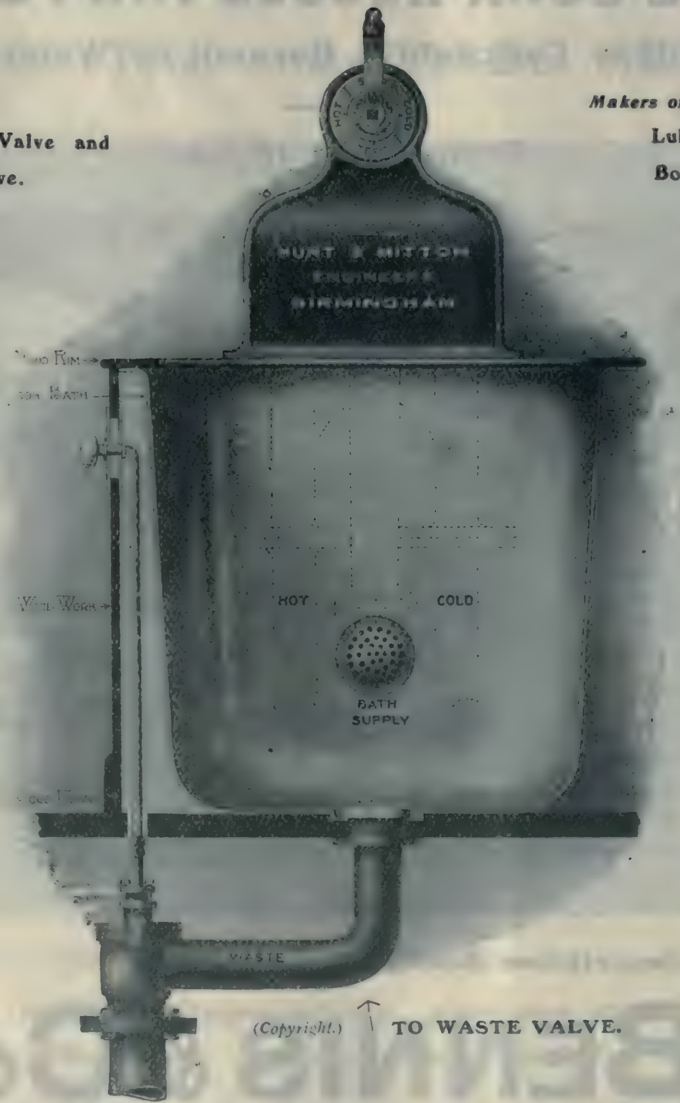

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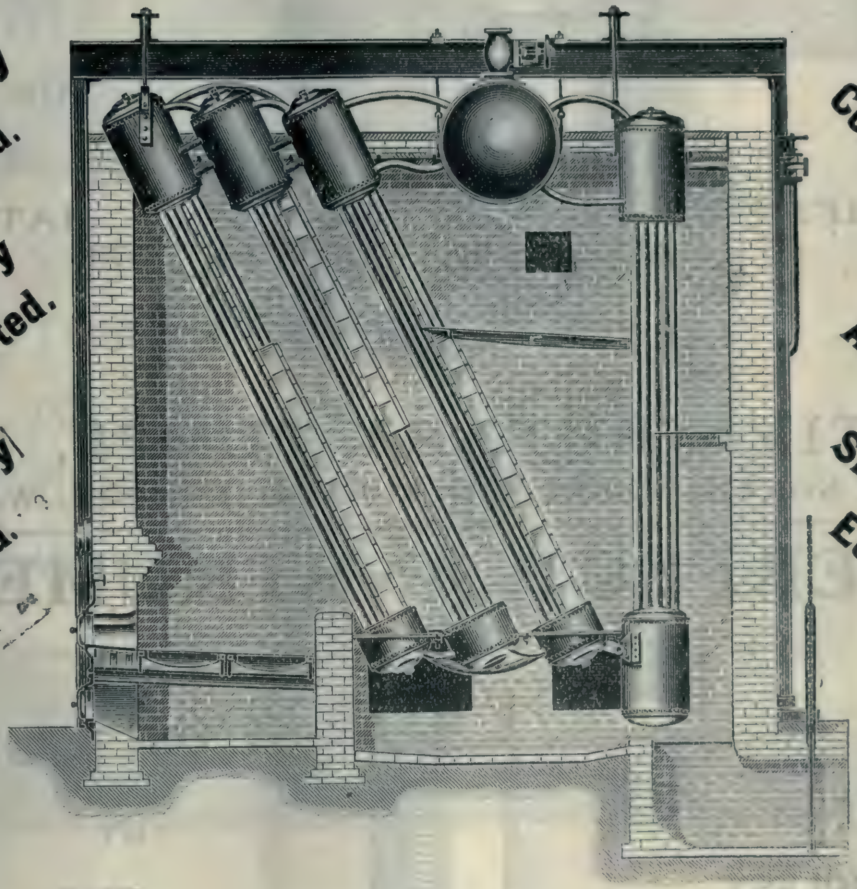

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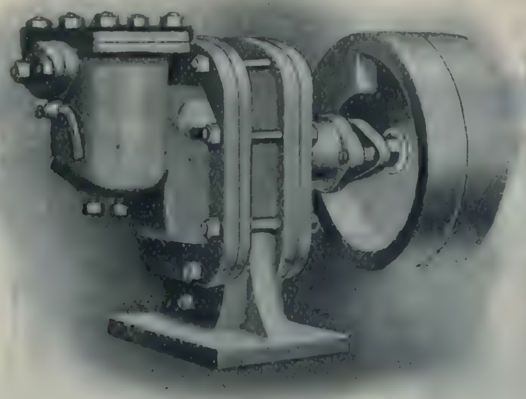

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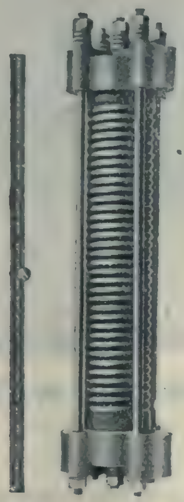

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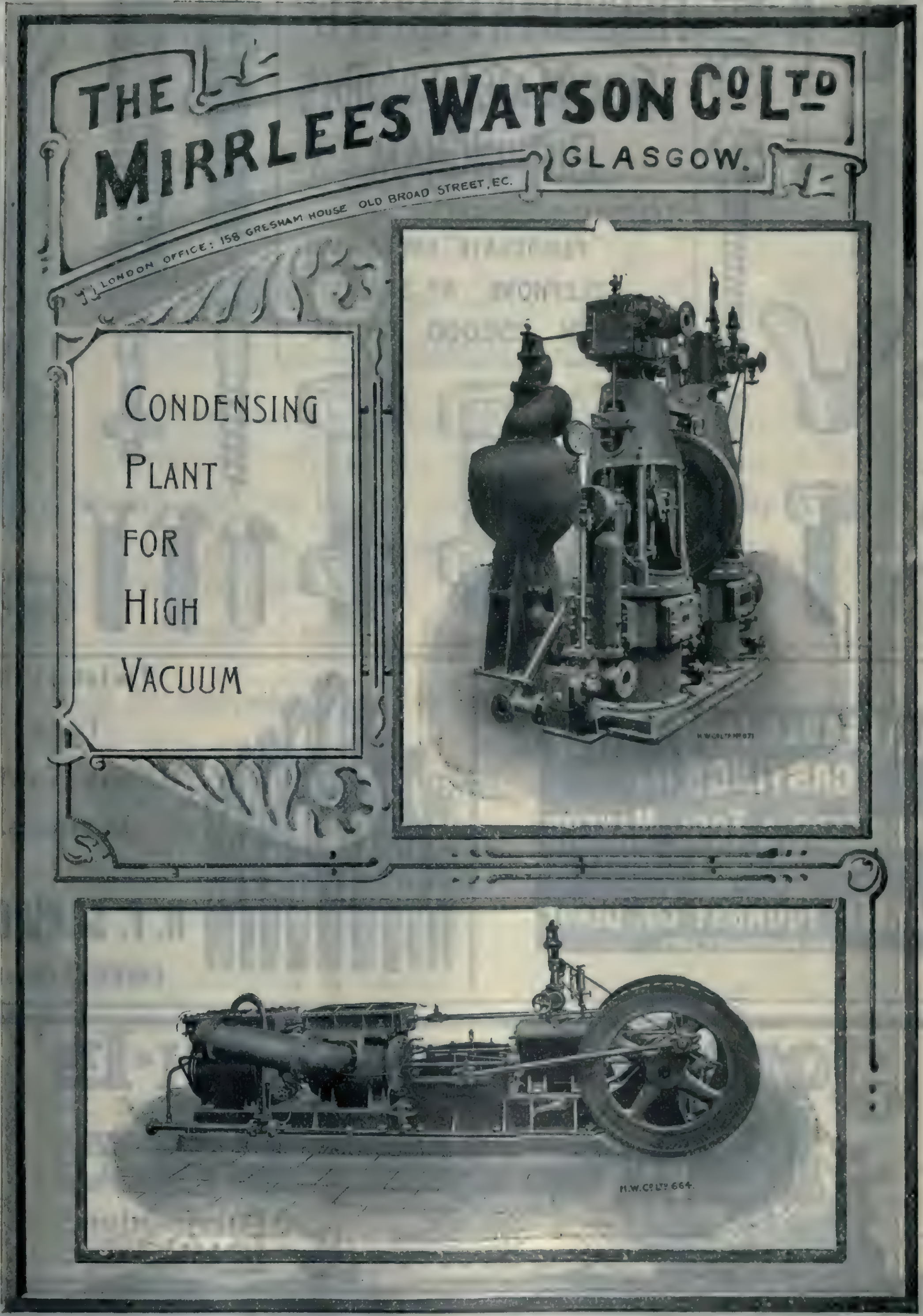

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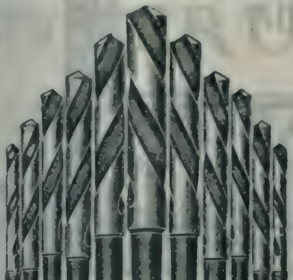

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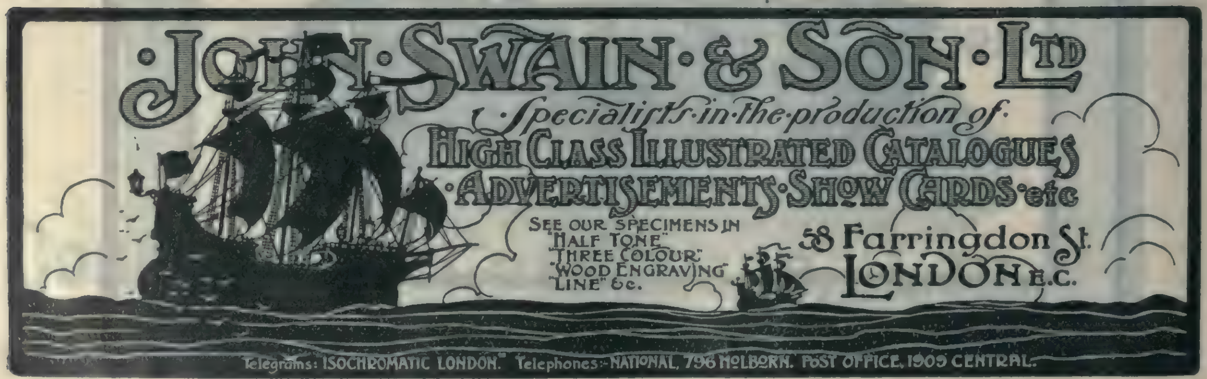

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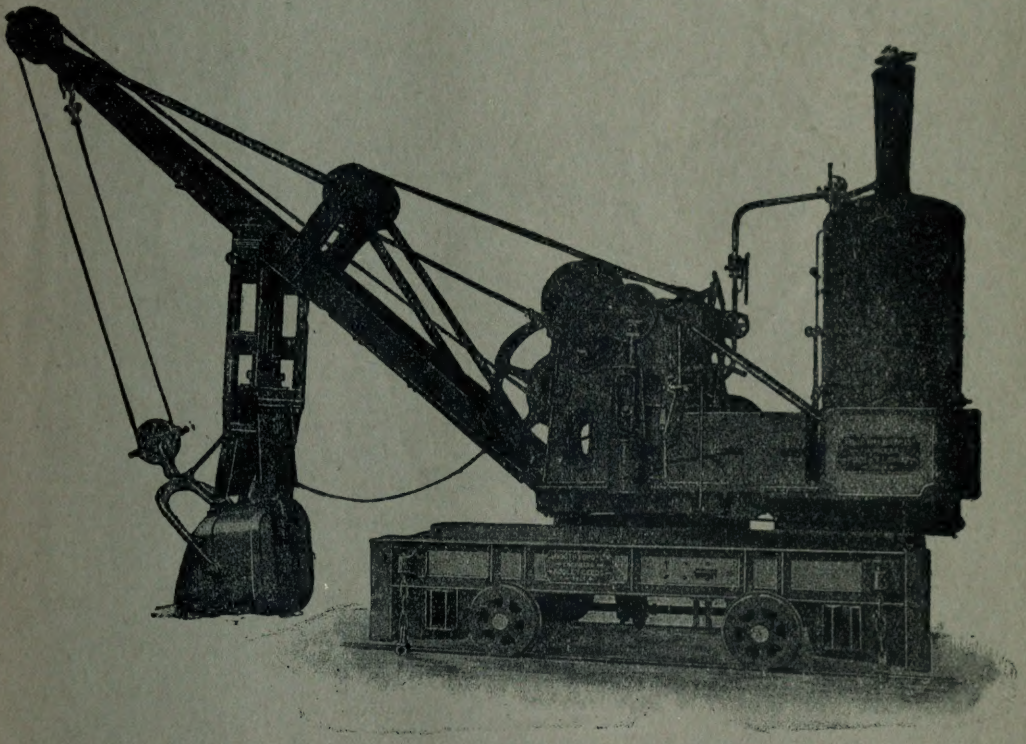

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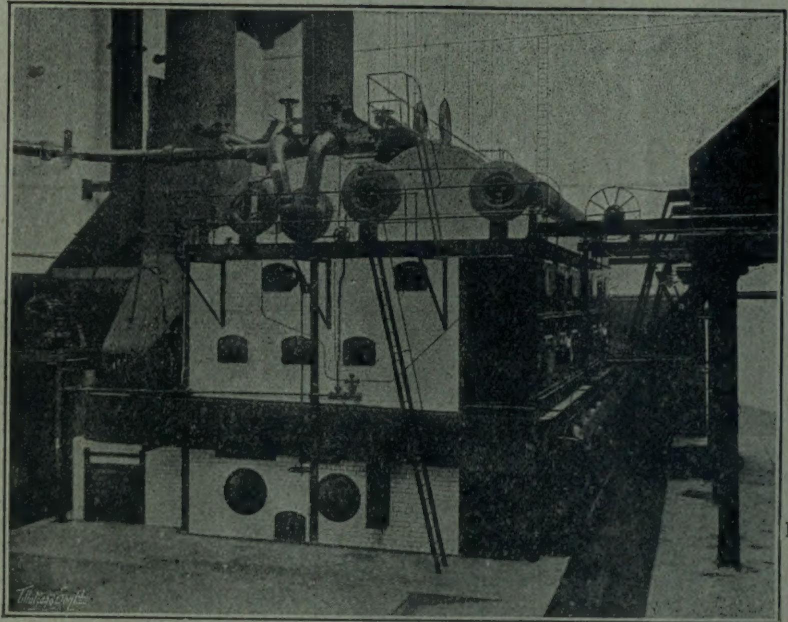

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